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Japanese Pacific Island Defenses 1941–45

Gordon L Rottman • Illustrated by Ian Palmer

Fortress • 1



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Abbreviations

amtrac	amphibian tractor
AA	anti-aircraft
AP	armor-piercing
AT	antitank
HE	high explosive
HMG	heavy machine gun
IIB	Independent Infantry Battalion (Japanese)
IJA	Imperial Japanese Army
IJN	Imperial Japanese Navy
LMG	light machine gun
NCO	non-commissioned officer
rpm	rounds per minute
SNLF	Special Naval Landing Force (Japanese)
UDT	Underwater Demolition Team (US Navy)
US	United States

Linear measurements

Distances, ranges, and dimensions are given mostly in the contemporary US system of feet, yards, and statute miles rather than metric. To convert these figures to metric the following conversion formulae are provided:

feet to meters	multiply feet by 0.3058
yards to meters	multiply yards by 0.9114
miles to kilometers	multiply miles by 1.6093

Glossary

The terminology used to define the different types of fortifications in World War II was by no means firm, with most terms used loosely to describe a broad range of fighting and weapons positions. The information below attempts to provide both a key to understanding and a standardized approach.

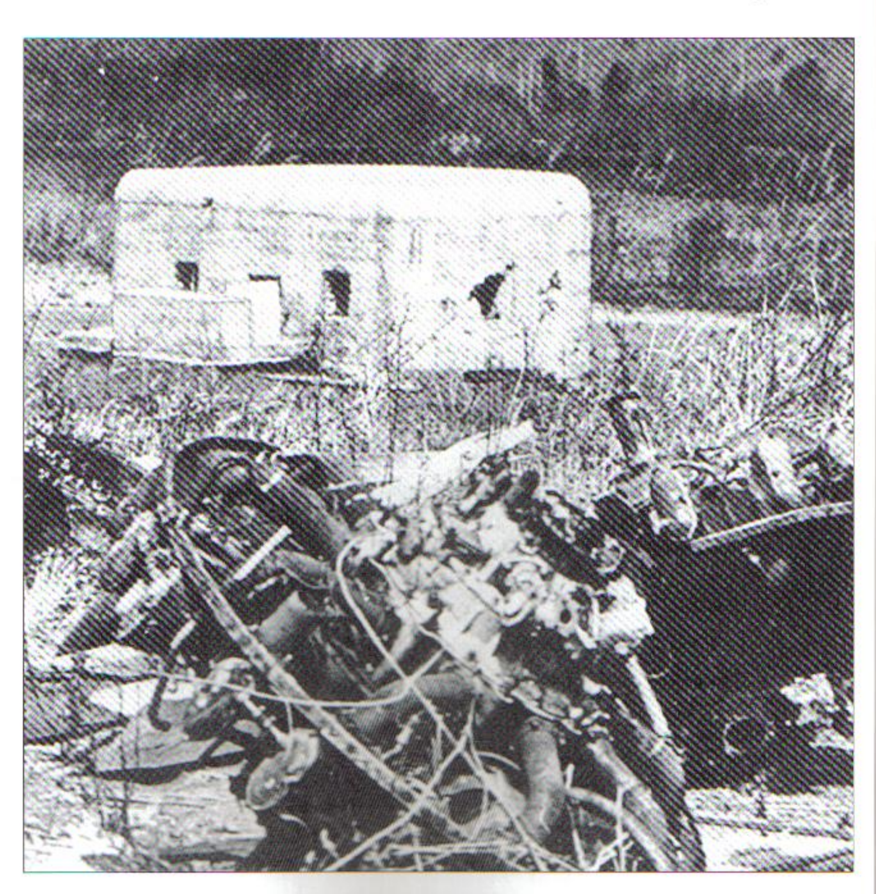
Alternate position One that covers the same *sector of fire* as the *primary sector*, and that allows a weapons crew to move there if the *primary position* becomes untenable
Avenue of approach A route the enemy may use to move toward its objective
Blockhouse Usually a large, above-ground concrete *bunker*
Bomb shelter A heavily constructed *bunker*, seldom actually bombproof
Bunker A general term for a fortification with overhead *cover*, built of any material, possibly housing a weapon
Camouflage The disguising and concealment of troops, weapons, vehicles, equipment, and facilities, either artificial (nets, paint) or natural (vegetation, terrain irregularities)
Casemate Another word for a heavily constructed *bunker* housing a large weapon and providing a firing port
Communications trench A trench connecting fighting trenches and other positions providing protected movement
Concealment Protection from observation, but not necessarily fire
Cover Protection from fire *and* observation
Crossfire Fire directed on an assault force endeavoring to attack one position from another position
Dead ground/space An area of low ground that cannot be directly fired into or observed from a position
Decoy/dummy A weapon, vehicle or aircraft that diverts observation and fire from actual equipment or that serves for the purpose of deception
Defilade The positioning of fortifications, troops, or equipment to protect them from frontal or *enfilading* fire or from enemy observation
Dugout A simple shelter dug into the side of a trench, ravine or hillside
Enfilade A weapon positioned so that it is able to fire along the linear axis of a target
Embrasure A firing port within a *bunker*
Fighting trench A trench that allows infantrymen to fire weapons from it, sited to cover specific areas with fire
Foxhole A small pit housing one to three riflemen or a light machine gun crew
Machine gun nest A machine gun position without overhead cover
Mutual support Covering fire for a defensive position from other positions
Observation post An observation position ranging from a well-concealed individual position to a heavily protected *bunker*
Parapet Additional cover for a position or trench comprising the earth dug from it piled around its sides
Pillbox A *weapon position* with overhead cover
Primary position A position providing the *primary sector of fire*
Primary sector of fire The principal mission of a weapons crew
Sector of fire A designated area on which fire from a position is directed to halt or deny enemy movement
Slit trench A short trench not connected to other positions
Supplementary position A secondary field or *sector of fire*
Weapon position/pit An open-topped firing position, either below or above ground, protected by a berm or *parapet*

Contents

Introduction

Hundreds of books relate the many Pacific island battles of World War II and the resolve of the Japanese defenders. All affirm the skillfulness of Japanese camouflage, the tactically-sound positioning of defenses, the effective use of terrain, the ability to develop mutually supporting positions, and the fortifications' ability to withstand massive firepower. While the war in the Pacific was a war of vast distances and maneuvering on a grand scale, the island fighting saw little movement of large, mobile forces. The nature of combat was slow and grueling: it was fought yard-by-yard over rugged terrain in a harsh environment against a determined and resourceful enemy. It was brutal almost beyond description with no quarter given by either side.

This study focuses on the defenses and field fortifications constructed on Pacific islands by the Japanese combat troops defending them. Large, permanent fortifications are beyond the scope of this work. This book will thus concentrate on temporary and semi-permanent crew-served weapons positions and individual and small-unit fighting positions, constructed with local materials and some supplied engineer construction materials. Obstacles and minefields incorporated into the defenses are also discussed. While wartime intelligence studies and reports provide detailed information on Japanese island defenses, little postwar study has been undertaken. This is largely due to the temporary nature of the defenses, their remoteness and the fact that little survives of them today.



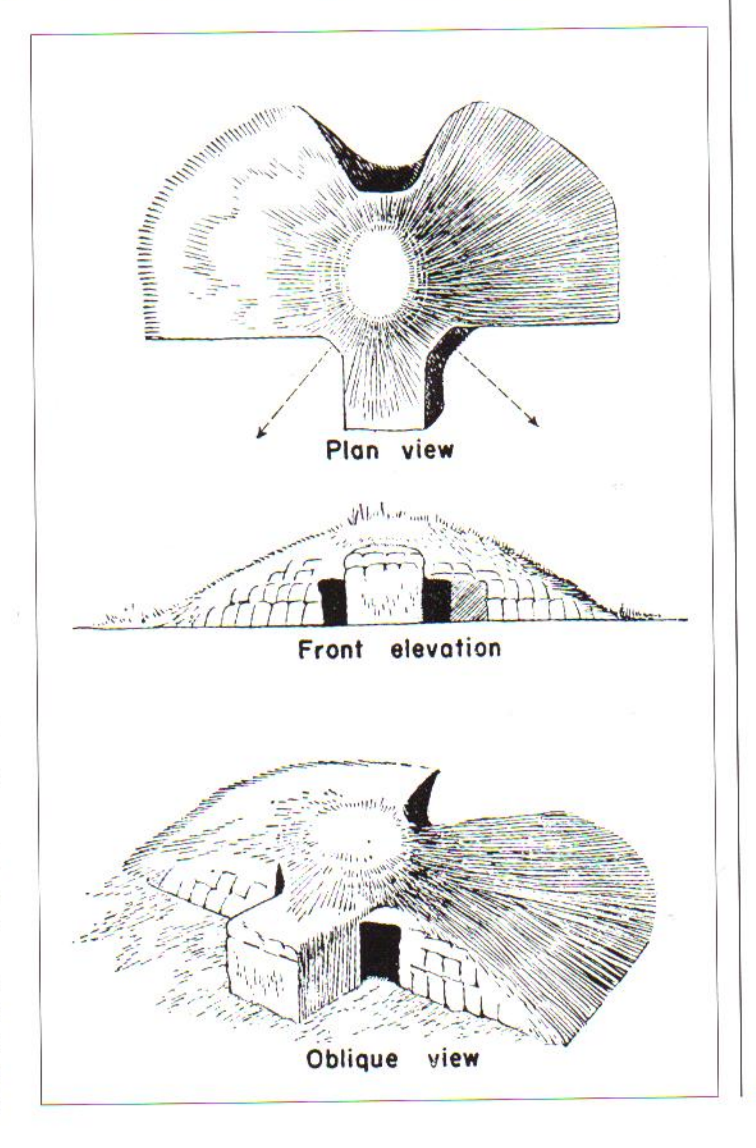
Concrete blockhouses such as this one on Saipan were used for command posts, radio stations, and to shelter various support facilities. Often little effort was made to camouflage them as they were purely bomb shelters and not intended as fighting positions.

Japanese island defense doctrine

Every Japanese manual from 1909 focused on the importance of offensive action to achieve victory. What the Japanese lacked in firepower and *matériel* was to be made up for by spiritual power, superior martial values, and total dedication to fulfilling one's duty, even if it meant attacking a superior force with bayonets or defending a position to the death. An officer corps evolved which loathed defense and fixed fortifications. However, the Pacific War became nothing more than a series of defensive battles for the Japanese, a war of attrition that they did not have the resources to win, nor even to achieve a stalemate.

The US Army's 1944 *Handbook on Japanese Military Forces* describes the Japanese attitude toward defense. "The defensive form of combat generally has been distasteful to the Japanese, and they have been reluctant to admit that the Imperial Army would ever be forced to engage in this form of combat. So pronounced has been their dislike for the defensive that tactical problems illustrating this type of combat is extremely rare."

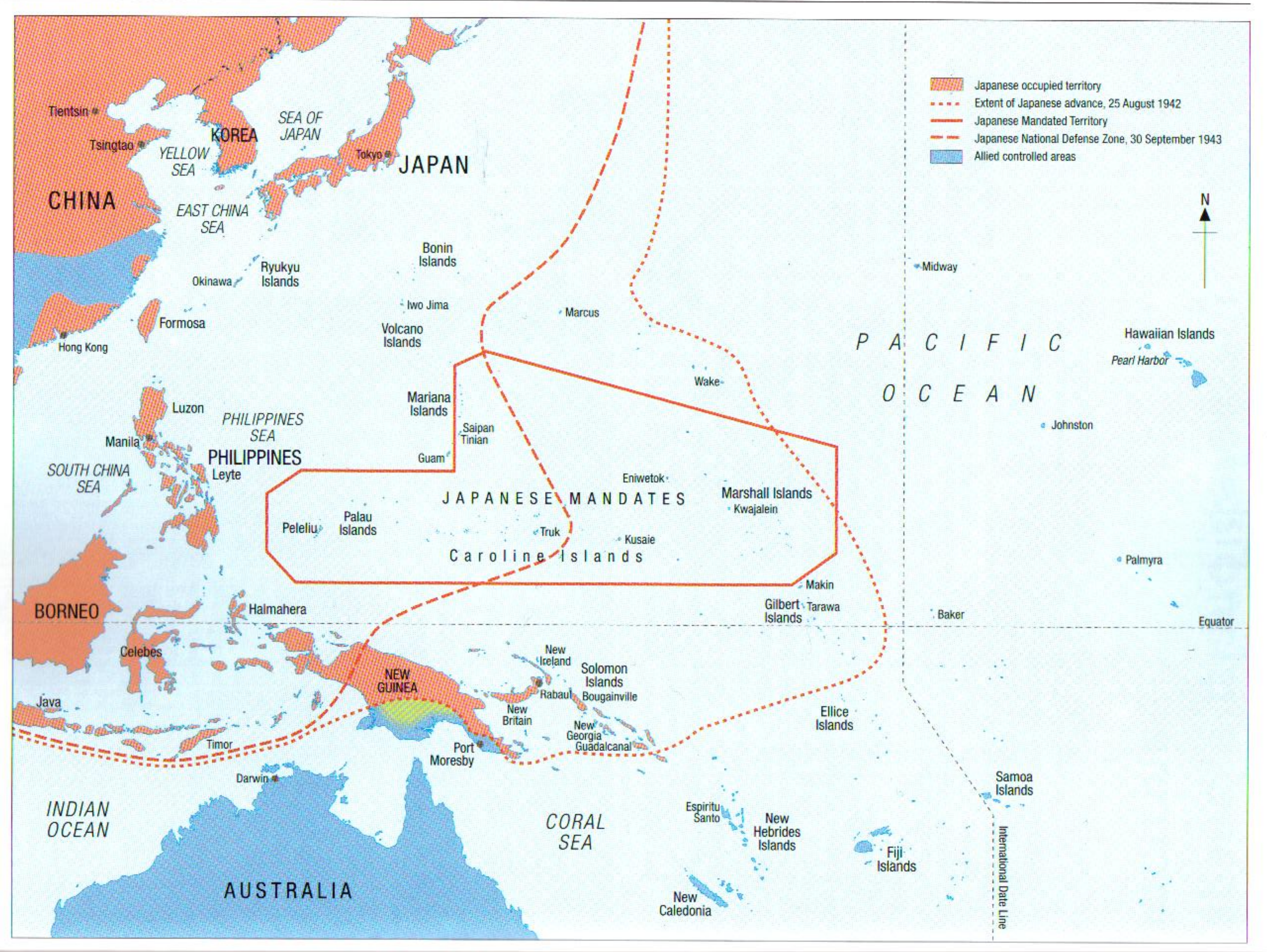
A double-bay bunker housing two HMGs, each with an individual sector of fire. Such a position would be well camouflaged with growing vegetation. The bunker was divided into two compartments to prevent both weapons from being knocked out by a single satchel charge or bazooka rocket.



The 1938 Combat Regulations (*Sakusen Yomurei*), still in effect at the beginning of the Pacific War, called for passive defense in the face of overwhelming enemy superiority (unyielding resistance until additional forces arrived to resume the offensive): prior to this the Japanese had adhered only to the concept of active defense. Active defense was only to be adopted when the enemy gained local superiority and continued until operational initiative could be regained and the offense resumed. In reality, because of the previous schooling and aggressive nature of Japanese officers, the conduct of the defense on Pacific islands was essentially active defense. Their goal was to halt the enemy at the water's edge, and if unable to decisively defeat him there they sought to reduce his strength, and conduct immediate counterattacks to keep him disorganized until mobile reserves could annihilate him.

Among the key problems Japan faced were the vast distances involved, limited shipping, brutal climate, and numerous health hazards. She was compelled to defend islands in widely varied terrain and weather conditions – from barren, rocky, sub-arctic outposts to vast, mountainous, rainforest-covered islands.

The initial Japanese defense concept in the South Pacific was to establish a series of airfields and naval bases throughout the dense island chains. These would serve to launch further conquests, to protect the



The Pacific Theater at the extent of the Japanese conquest and the subsequent establishment of the National Defense Zone.



This machine gun pillbox is provided with a rough-appearing firing port, but was difficult to detect from the ground. Built beneath a tree, it was virtually impossible to detect from the air. Camouflaging palm fronds had been pulled away so that the position could be photographed.

flank of Japanese forces in the Southwest Pacific and to provide an outer guard to the inner defense zone in the Japanese Mandated Territory. The Battle of Midway (June 4, 1942) halted the Japanese conquest.

The Allied offensive in the South Pacific began on August 7, 1942 when the Marines assaulted Guadalcanal and adjacent islands. The massive air, naval, and *matériel* power that the Allies brought to the battlefield meant that the Japanese could not engage maneuver warfare or launch counter-offensives. No Allied amphibious assault was defeated: once an island was secured by the Allies, no Japanese attempt was ever made to retake it. In the South Pacific the "island hopping" strategy was developed, the concept of attacking where the Japanese were weak and bypassing the most strongly-held islands. These would be cut off or allowed to evacuate.

An early-war Japanese report, *Concerning Defense Against Enemy Landings*, stated that enemy forces must be annihilated on the shore, and that, "therefore the second or third line of defense positions ordinarily will not be established very far to the rear." However, most of the islands on which the early South Pacific battles were fought were quite large, hilly and thick with jungle. It was impossible to defend the many miles of beach-lined coasts.

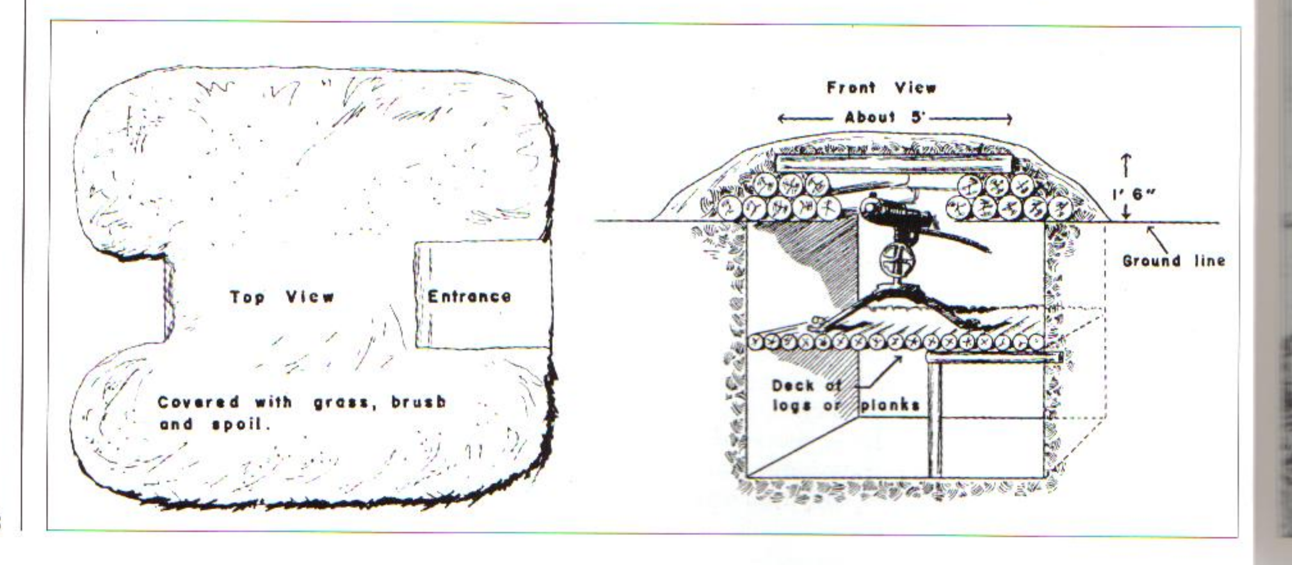
The Japanese were taken by surprise at Guadalcanal. The Marines landed unopposed and the construction troops fled into the jungle allowing the Allies to secure a valuable forward airbase. It was a different matter on tiny Tulagi and Gavutu islands across the Slot from Guadalcanal. Special Naval Landing Force (SNLF) troops fought a vicious battle on those hilly, cave-strewn islets. Although not nearly as extensive or well prepared as cave defenses tackled later in the war, they were the first such caves to be encountered. The Japanese funneled in significant reinforcements, and after the initial Marine defense of the Henderson Field perimeter, Army and Marine units began a slow, creeping offensive westward along the north coast. The Japanese established repeated defense lines on ridges and small rivers running inland perpendicular to the coast. The hill and ridge sides were forested, but the open crests were covered only by high kunai grass. They also employed the area's few caves. However, most of the defenses were hasty field fortifications prepared as the Japanese were forced toward the island's west end, from where survivors were evacuated in February 1943.

Later operations on New Georgia, Bougainville, and New Britain found the Japanese better prepared. Lookouts and small detachments were positioned to cover the most likely landing beaches on these sizeable islands, aimed at delaying the enemy until large units could respond from the island's main bases. The Japanese were able to accomplish this as the dense jungles and numerous tracks allowed large units to move relatively unmolested by the Allies' inadequate airpower. The US occupation of New Georgia began in June 1943 with multiple small unit landings scattered about the island to eliminate many of the Japanese detachments. It culminated in a brutal pitched battle at Munda Point where the Japanese wasted themselves defending an unusable airfield.

Bougainville and New Britain (November and December 1943 respectively) were similar in that the Marines established beachheads where airfields were built. No effort was made to clear the entire island. The Japanese battered themselves against well-defended Marine and Army perimeters until forced to withdraw to the opposite end of the island and dig in. No effort was made to dislodge them and they sat out the war while the Allies continued to use their new airfields. Rabaul, the massive Japanese naval and air base on the east end of New Britain, was completely cut off from the outside by a major Allied air and naval effort: it surrendered at war's end.

The war took a new turn in November 1943 when the Army and Marines descended on the Gilbert Islands, and the nature of Japanese defenses changed too. On the Gilberts, Marshalls and Carolines, which comprised dozens of atolls, only a few atolls were developed and defended by the Japanese, namely those with islands large enough to support airfields, and seaplane and naval bases. Usually only key islands were developed as bastions, with lookouts and small detachments being placed on some islets. Their defense was the responsibility of the Imperial Japanese Navy (IJN), but some Imperial Japanese Army (IJA) units were involved in this. While IJN Land Forces employed their doctrinal defense at the water's edge, IJA units in the islands were forced to do the same. The islands were simply too small for any form of maneuver or subsequent lines of defense.

The defended island was ringed with trenches, rifle pits, machine guns, anti-boat guns, and coast defense guns. Anti-aircraft guns were generally positioned on or near the shore to double as anti-boat weapons. Most positions were covered, except for larger AA and coast defense guns. All artillery was incorporated into the beach defense for direct fire: space was not sufficient to position it far enough in the rear to allow indirect fire. Usually the only "field artillery" on these islands



A simplified sketch of an HMG pillbox encountered by the Marines on New Britain. Construction varied greatly, but such pillboxes were among the more frequently found Japanese fortifications.

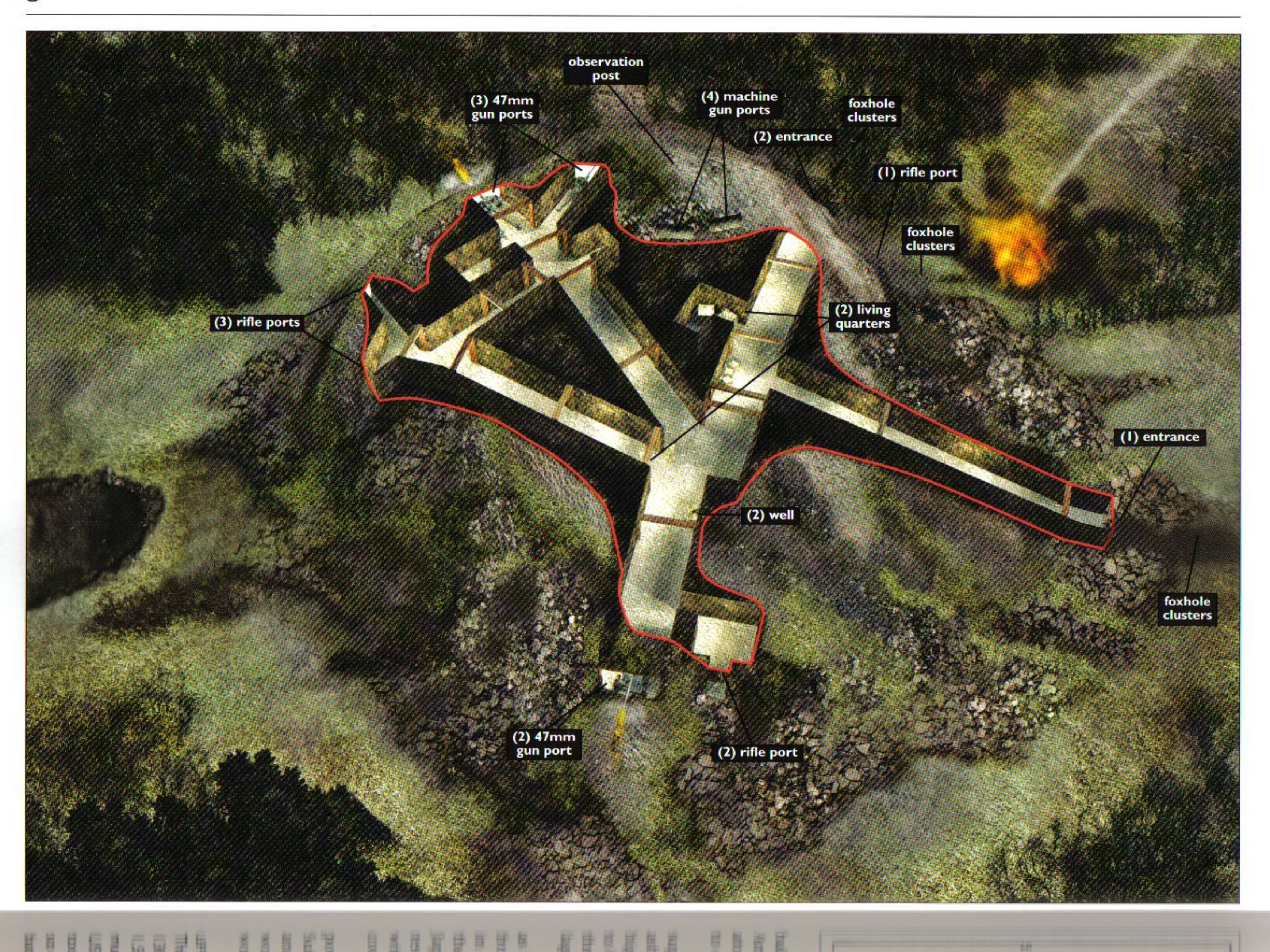
Japanese fortification thickness standards

Japanese classification	Standard of strength (offers protection from)	Reinforced concrete	Rock and coral	Rock and brick	Sand and soil
Special A	1 ton bomb or 16in. shell	9.75ft	16.5ft	–	–
Special B	500 lb bomb or 8in. shell	5ft	8.25ft	–	–
A	250 lb bomb or 5/6in. shell	2.6ft	5ft	6.5ft	26ft
B	100 lb bomb or 3in. shell	1.66in.	2.66ft	4ft	16.5ft
C	25 lb bomb or large live fragments	1ft	1.66ft	2.33ft	6.5ft
D	13.2mm and smaller bullets or small live fragments	2.5–4in.	9in.	9in.	3.25ft

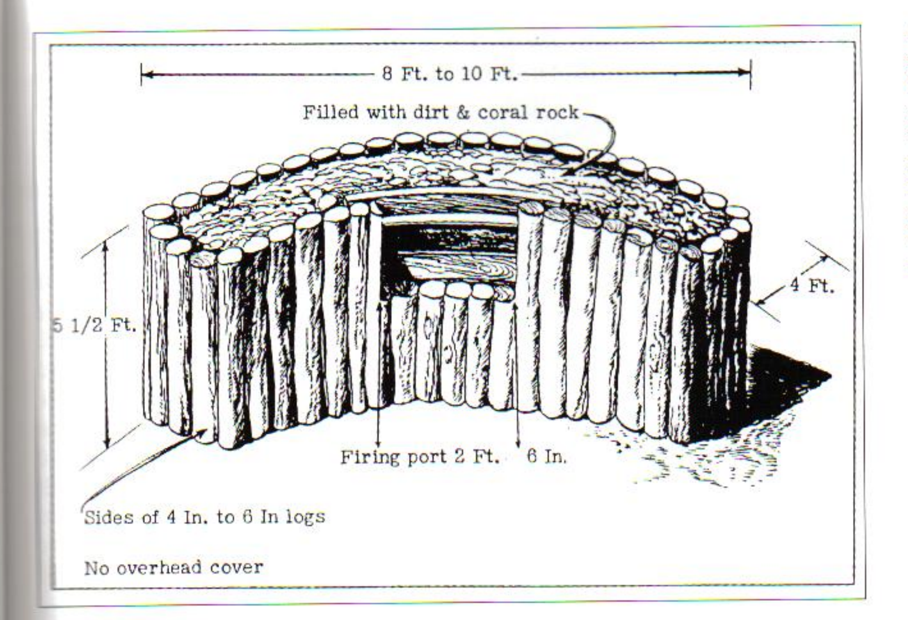
comprised light infantry guns. Strongpoints were spaced along the shore as well as inland, especially around command posts, space permitting. Even if all or most of the island's perimeter could be defended, the defenses were sometimes concentrated in interconnected defended areas, essentially large strongpoints, with light defenses in between them. Antitank ditches were dug to block the passage of armor into key areas. The airfield occupied much of the island, but even it was incorporated into the defense as it provided an exposed field of fire deadly for the attackers to cross. Defenses were established along its edge to cover the far side. If the island was too large for the entire shoreline to be defended by the available forces, a central defended area was established with both strong beach defenses and cross-island defense lines. The Japanese tended to deploy the



Soldiers examine an IJN 120mm Model 3 (1914) coast defense gun knocked out by a destroyer on Hauwei Island, Admiralty Group. Such gun positions were often a simple circular pit dug in the sand, often without interior revetting. Most coast defense guns were originally designed to be mounted on ships. They retained their steel pedestal mount and were fitted to heavy timber and concrete platforms for shore duty.



observation post
(3) 47mm gun ports
(4) machine gun ports
foxhole clusters
(2) entrance
(1) rifle port
foxhole clusters
(3) rifle ports
(2) living quarters
(1) entrance
(2) well
foxhole clusters
(2) 47mm gun port
(2) rifle port



An early type of rifle position encountered on Butaritari Island, Makin Atoll by Marine raiders in September 1942. Suited for combat in China, such above-ground positions were ill-suited to the islands because of American heavy direct fire weapons as well as indirect fire (mortars, artillery, naval gunfire).

balance of their defenses on the seaward side of the islands, believing that the Americans would want to beach nearer to shore on the reef's edge. On the atoll's lagoon side the coral reefs were wider meaning landing craft were forced to discharge their troops further out.

At Tarawa, full-tracked amphibian tractors (amtracs), originally intended as supply carriers, were successfully used for the first time to deliver assault troops ashore by carrying them across reefs that landing craft could not cross even at high tide. The Japanese were slow to respond to this threat and often continued to bulk their defenses on the seaward side. It was not until the Americans moved through the Marshalls that efforts were made to reorient defenses toward the lagoon side, but it was too late.

The Japanese still hoped to lure the American fleet into a decisive battle as they attempted to seize islands. The Combined Fleet, air attacks launched from other islands, and submarines would hit the US fleet and, as hoped in earlier operations, drive it off as the assault troops were defeated at the water's edge. As on the larger islands in the Solomons and Bismarcks the Japanese established mobile reserves, but this time they were an amphibious reserve supported by landing craft and situated on a centrally located island within the group, to be deployed to a threatened island or to conduct a counter-landing.

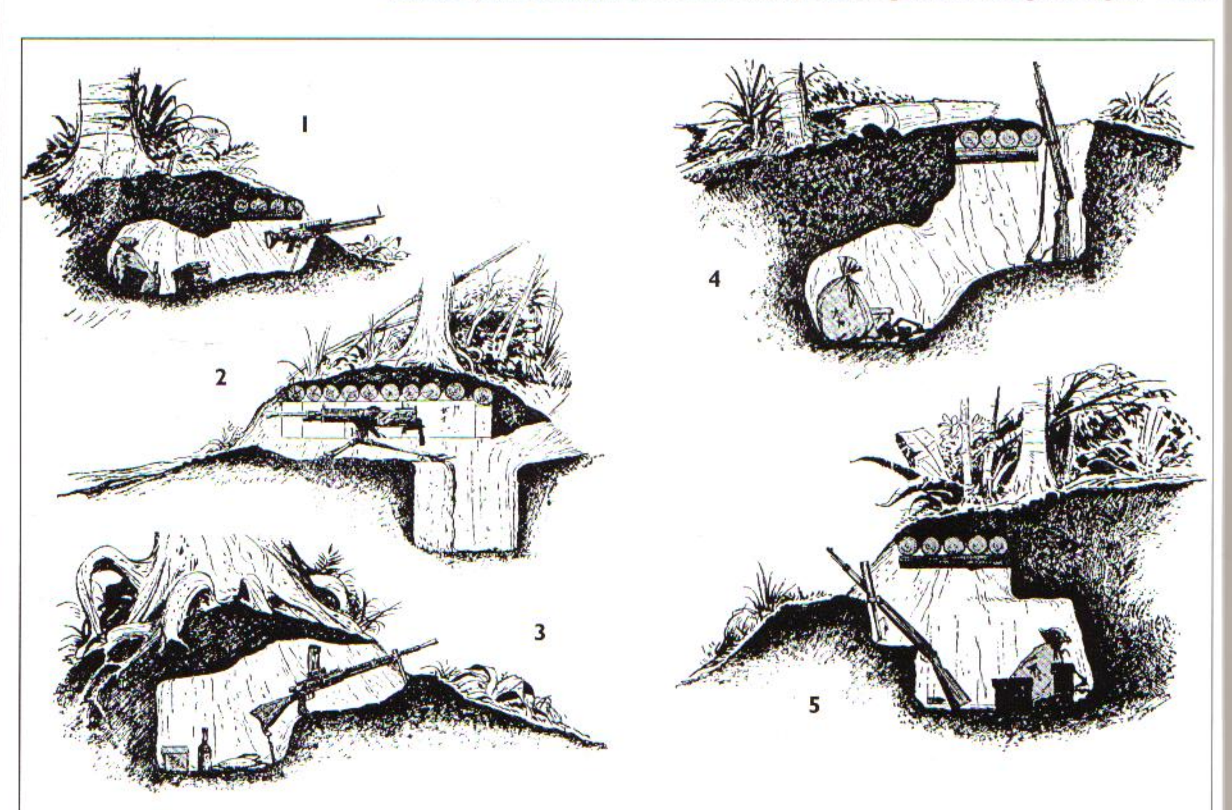
The plan was doomed. Once an island group was targeted, the Americans pounded area islands with long-range bombers, neutralizing the airfields. Submarines would hunt down Japanese shipping in the area. Battleships and cruisers bombarded the islands without fear of air attack. Adjacent islets would be cleared of lookouts, then the first waves of Marine or Army troops would land on the lagoon side of the island's central portion, turn in opposite

LEFT **A hill strongpoint**
This is an approximation of the internal defenses of Hill 130, what the Americans called the "Chocolate Drop," 1,500 yards northeast of Shrui, Okinawa. It is typical of multi-level hill strongpoints with an all-round defense. The US 77th Infantry Division, approaching from the north, took from May 11–17 to capture it, losing ten tanks and so many infantry that a regiment was reduced to a battalion. There are four levels, connected together by inclined passages: each level is indicated here by the number before a particular feature on that level. The hill's surface was rocky and partly covered by low scrub brush. Foxholes and trenches were scattered about the hill to protect the well-camouflaged firing ports and entrances along with the observation post on the peak, especially on the reverse slope. The three 47mm AT guns and four HMGs defending the hill could be shifted to different embrasures and between the second and third levels.

directions, and fight their way to the island ends. The island was declared secure when organized resistance ceased, but mop-up operations might last for weeks. The conventional island perimeter defense was proven ineffective when attacked by a force possessing superior naval and air power. A defense of considerable depth was necessary, one that would provide flexibility and elasticity.

The next islands marked for assault offered the Japanese that opportunity. The Mariana and Palau islands were larger, ruggedly hilly, and thick with vegetation. A completely different kind of defense was established on these islands in the summer of 1944. The Japanese goal was still to defeat the invaders at the water's edge, but a more realistic appraisal had been considered. Positions in depth were prepared on most islands with units (regiments and battalions) assigned sectors in which defense lines and strongpoints were constructed. A mobile reserve with tanks was positioned in an area away from the expected landing beaches. This force was to conduct a counter-attack and destroy the landing force in a decisive battle. Sea and air attacks were still contemplated. A significant change in doctrine was the virtual disappearance of *banzai* charges. Though these occurred on Saipan and smaller ones were experienced on other islands, the Japanese had realized that such suicidal attacks only hastened the garrison's end.

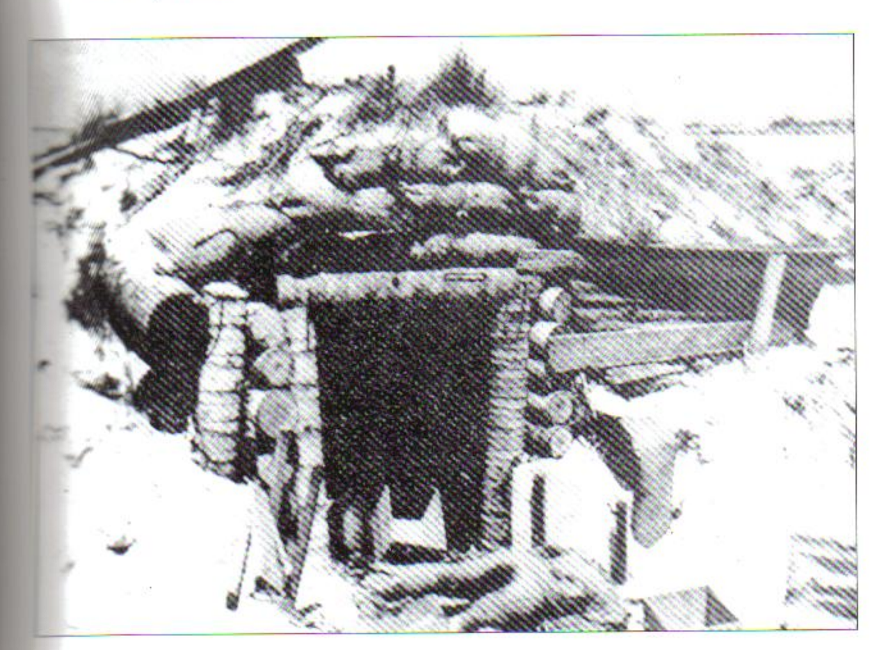
American air and naval power made the mobile reserve virtually undeployable though. Movement was all but impossible except at night. When



Examples of small Japanese individual fighting positions.
1. 7.7mm aircraft machine gun modified for ground use. **2.** 7.7mm HMG. **3.** 7.7mm LMG. **4.** Rifleman.
5. 50mm grenade discharger.
Such positions, often dug beneath trees, were difficult to detect and offered protection from grenades, small arms, and mortar fire.

A dense trench system prepared for water's-edge beach defense on Kwajalein Atoll, January 1944. Individual rifle and LMG pits are connected by unrevetted 2- to 2.5ft-wide, 3ft-deep trenches. Small coconut log bunkers were provided for each section for protection from naval bombardment.

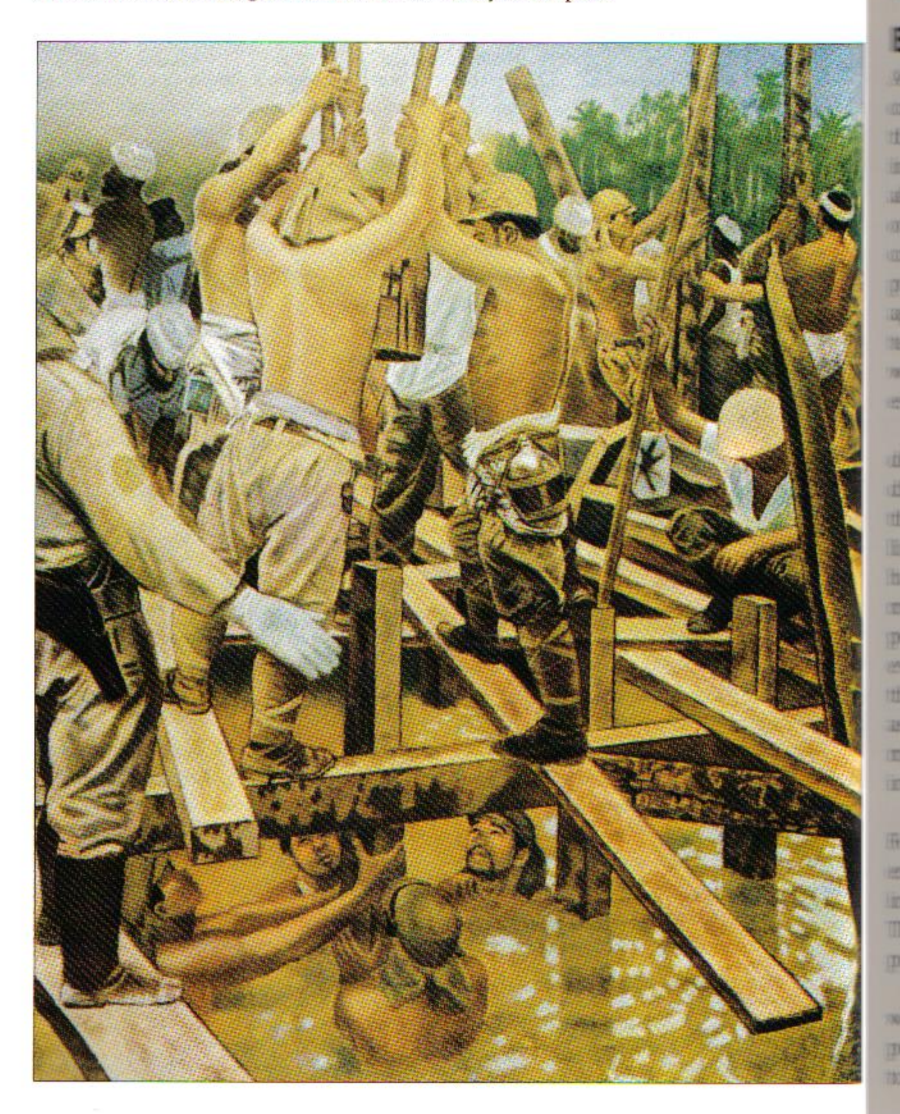
the counterattack was launched, it was too little, too late. The Americans were capable of landing such massive, well-supported forces in a surprisingly short period that the reserve was too small to have any effect. By the time they attacked, much of the supporting artillery had been destroyed and the armor was easily dealt with. Local counter-attacks were equally unsuccessful and even a large counter-offensive on Okinawa failed dismally. External reinforcement was seldom possible.



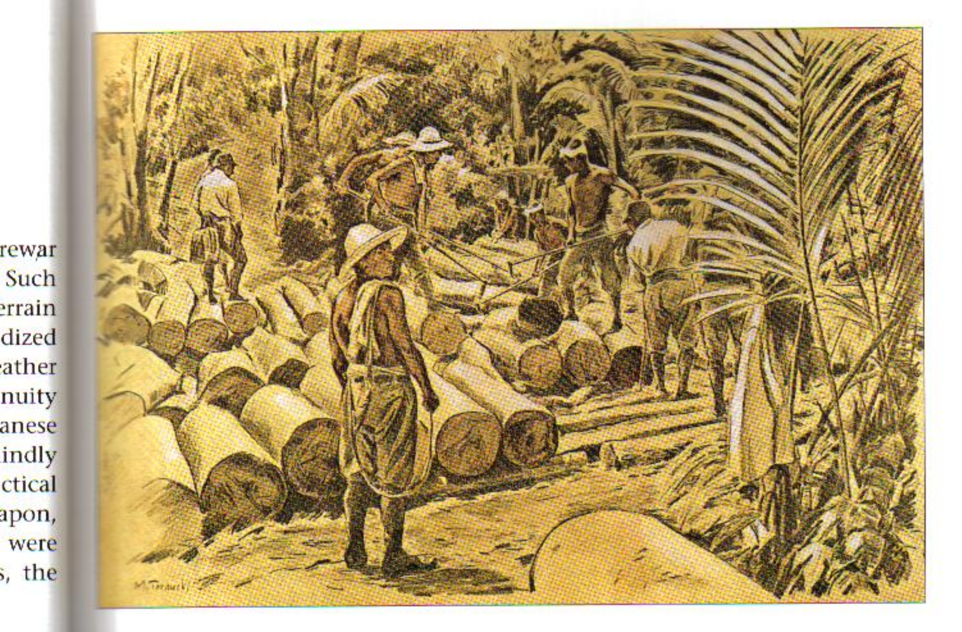
A heavily constructed troop bunker on Betio made of double coconut log walls filled with sand. The sand-bagged roof was over 4ft thick. While the landward side wall was only partly banked with sand, the seaward side had over 6ft of sand piled up. The Japanese made extensive use of blast barriers to protect the entrances of even one-man rifle positions in the seawall, but this bunker lacked such protection.

Building and manning the island defenses

The basic design of the island fortifications was based on the dictates of prewar manuals, but there were many variations and exceptions in the field. Such variations were provoked by the need to blend the fortification into the terrain (requiring its size, shape, and profile to be modified), locally standardized design induced by material shortages, types of material available, weather conditions, preferences and concepts of local commanders, and the ingenuity and imagination of the officers and NCOs supervising construction. A Japanese manual on field fortifications notes: "It is most important not to adhere blindly to set forms in construction work, but to adapt such work to fit the tactical situation." Dimensions, even for positions housing the same type of weapon, varied considerably and could be of irregular shape: local initiatives were the rule rather then the exception. Despite very different appearances, the common, basic design can be seen in many examples.



The Japanese had little access to mechanized engineering equipment and power tools. Muscle, sweat, and long hours were demanded of troops to build defenses and facilities. Here soldiers bridge a Pacific island stream. An effective road system was essential to the defense. In the upper left are two turbaned individuals, possibly Indian prisoners of war. (Original painting by Toshi Shimzu)



Japanese troops and local laborers cutting hardwood logs for revetting gun positions. Local laborers were used extensively for constructing support facilities, wood-cutting, and transporting materials, but the troops themselves constructed most of the fighting positions and defenses. (Original painting by Manjiro Teracuchi)

Establishing the defense

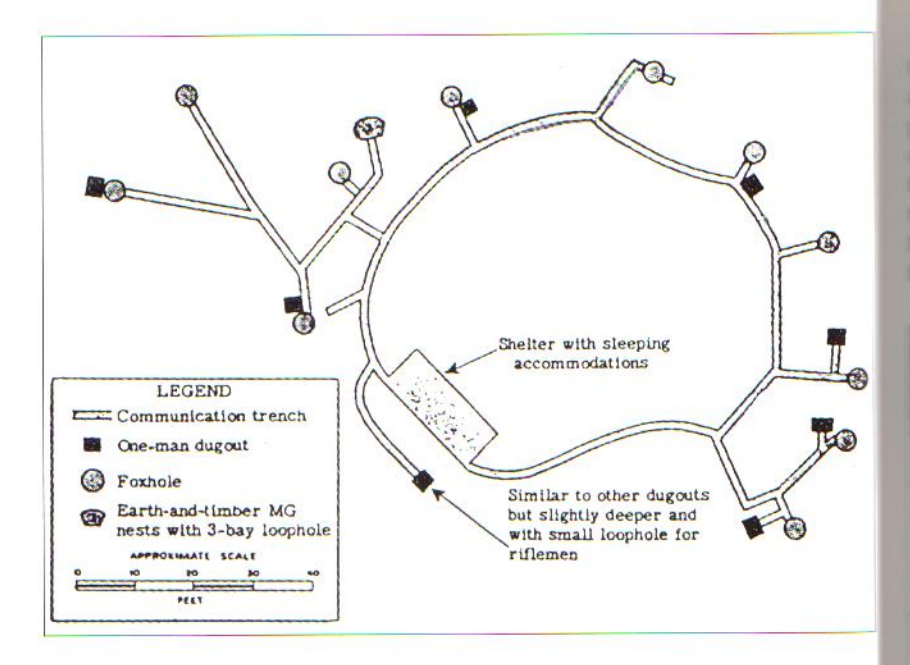
A unit was assigned a specific sector of defense and several factors were considered. Firstly came the direction from which the enemy would approach: the defenses were principally oriented in that direction. Avenues of approach into the sector from the flanks and rear through adjacent unit areas were also considered and some defenses, even if only supplementary positions, were oriented in those directions. While unit boundary lines were specified, with coordination, fields of fire from one unit's sector into an adjacent unit's were permitted to cover gaps. Weapons were also emplaced to cover avenues of approach into a unit's flanks regardless of the adjacent unit's dispositions. Key terrain features, which the enemy might attempt to occupy, were identified as were routes of advance through the defense sector, and defenses and obstacles established there.

Secondary defensive positions were selected to provide depth to the defense. This was a critical aspect to the Japanese and a factor that made it so difficult and slow for the Allies to break through. Defenses established in the depth of a unit's sector were not necessarily emplaced as continuous lines. Although they might seem to be randomly selected, they were not haphazardly chosen: they were emplaced to cover other defensive positions, movement routes, key terrain, and dead space not covered by the primary position. They were often emplaced to engage the enemy from the flanks or even the rear as they advanced. Individual fighting positions were scattered throughout some areas requiring the assault force to clear each. Often the assault troops would clear only the most troublesome, leaving reserve units to mop up bypassed positions: sometimes these were reoccupied by stragglers and infiltrators.

Inaccessibility was another factor affecting the choice of fighting position. For example, placing a position high on a steep hillside made it difficult for the enemy to approach while under fire. It is apparent that the concealment and inaccessibility of positions often took precedence over other considerations. The key aim was to establish crossfire from several directions and all-round protection from attack from any direction.

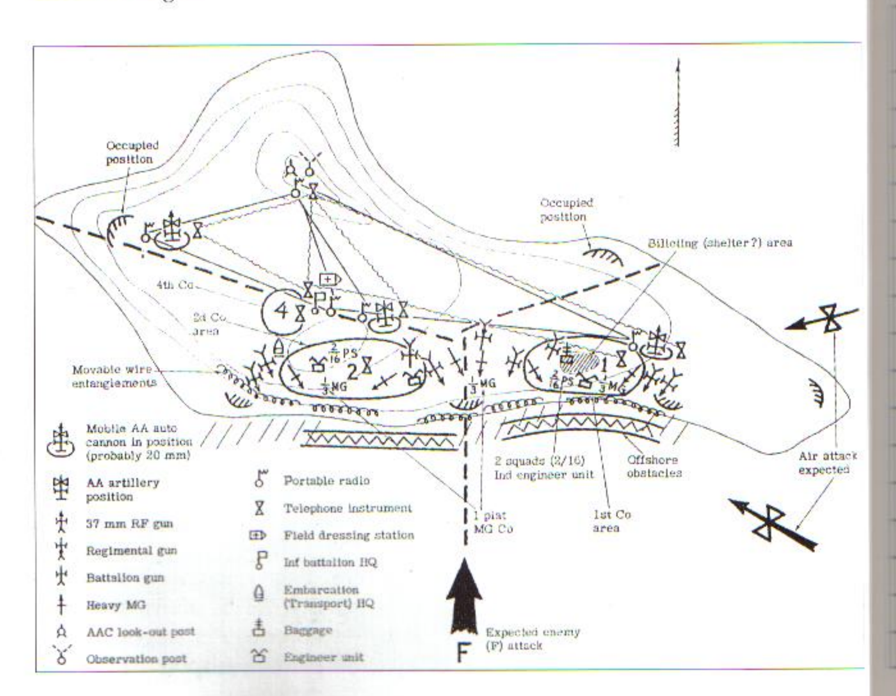
The actual selection of position, especially regarding crew-served weapons, was often determined by a commander one or two levels above the unit possessing the weapon. For example, a battalion commander might specify to his company commanders where every crew-served weapon was to be

Inland defenses were situated to provide an all-round defense. This section position comprises one-man foxholes, individual dugouts, an LMG pillbox and a log sleeping shelter all connected by shallow, narrow communication trenches.



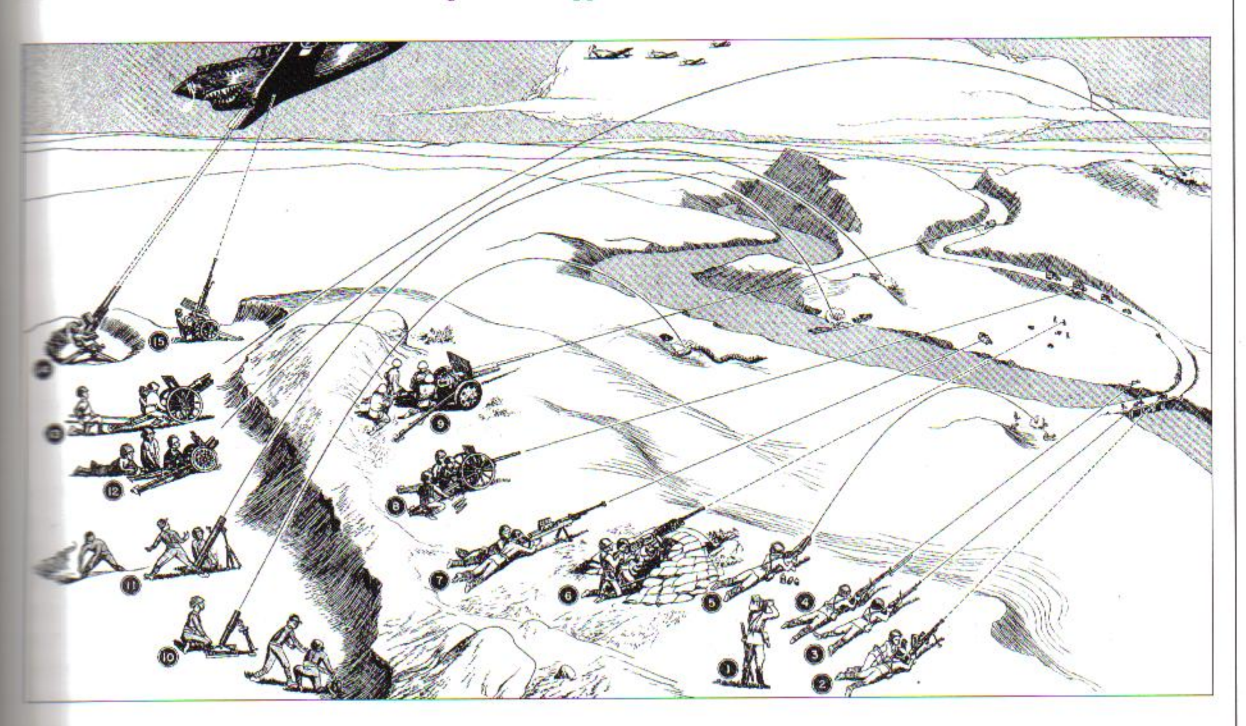
emplaced to ensure mutual support, the elimination of gaps between subunits, and sufficient depth to the defense. He or even the regimental commander might stipulate the location of obstacles and artillery concentration areas.

Terrain was carefully studied for incorporation into the defense, another key aspect of doctrine. Every cave, ravine, gully, ridge, hill, knoll, and fold in the ground was considered as either a defensive position or obstacle. Swamps, marshes, streams, rivers, dense vegetation, and broken ground could be reinforced with manmade obstacles or mines. If not covered by direct fire, obstacles were kept under surveillance and indirect artillery and mortar fire could be placed on them when the enemy approached. The Japanese emphasized the use of AT ditches and mines to reinforce their marginally effective AT guns.



Example of the defense of a small island, here Shemya Island in the Aleutian Islands off Alaska, defended by the 303d IIB, August 1942. The island measures 2.25 by 4.25 miles. The drawing is adapted from a captured Japanese sketch found on Kiska Island.

Often a key position was protected by clusters of smaller positions ranging from riflemen in foxholes, to light machine gun nests, to heavy machine guns and AT guns in pillboxes or caves. These too were protected by other covering positions. An enemy force attacking a large fortified cave position on one side of a gorge would find itself under fire from positions flanking the main position, from the opposite side of the gorge, and from the ridge above. In order to clear the gorge another assault force may have had to fight its way to the ridge top from another direction, secure the crest, and then assault covering positions from above while the first assault force provided suppressive fire from below.

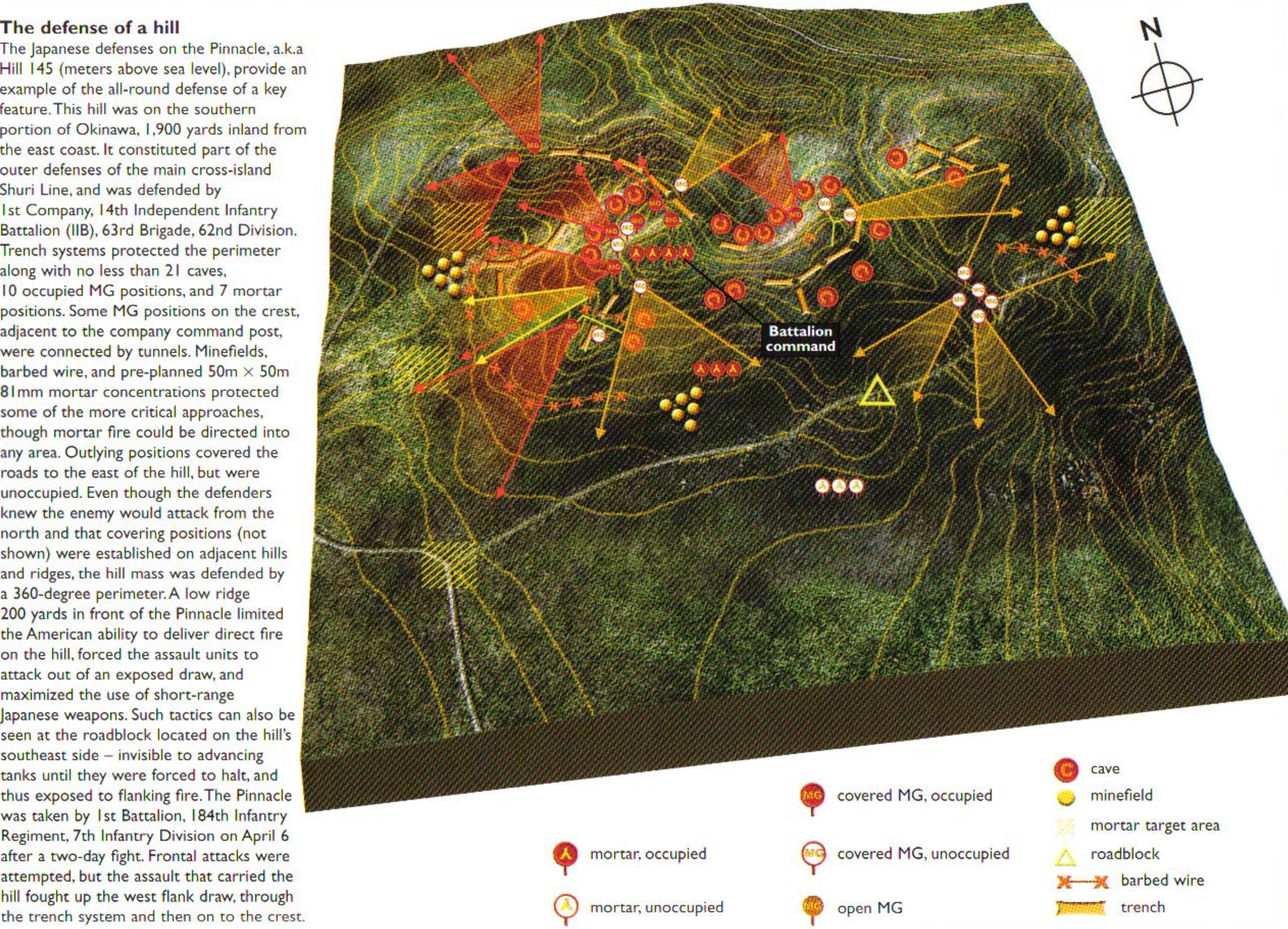


This schematic demonstrates the comparative ranges and trajectories of the most common Japanese infantry weapons. Extracted from a US 1943 Intelligence Bulletin, the characteristics have been corrected from the wartime publication.

Weapon	Weight (lbs)	Effective range (yards)	Rate of fire (rpm)
1. 8mm Model 14 (1925) pistol	2	17	8–16
2. 7.7mm Model 99 (1939) LMG	21.36	1,500	850 (cyclic)
3. 7.7mm Model 99 (1939) rifle	8.8	600	10–15
4. 6.5mm Model 38 (1905) rifle	9.4	400	10–15
5. 50mm Model 89 (1929) grenade discharger	10.25	175–710	10–20
6. 7.7mm Model 92 (1932) HMG	122	1,500	450–500 (cyclic)
7. 20mm Model 97 (1937) AT rifle	140	1,100	12 (semi)
8. 37mm Model 94 (1934) AT gun	714	2,500	10–20
9. 47mm Model 1 (1941) AT gun	1,660	2,500	10–15
10. 81mm Model 99 (1939) short mortar	52	3,280	15
11. 81mm Model 97 (1937) mortar	145	3,100	18–30
12. 70mm Model 92 (1932) battalion gun	468	1,500	10
13. 75mm Model 41 (1908) regimental gun	1,600	2,100	10
14. 13.2mm Model 93 (1933) twin HMG	87 each	3,000	450 (cyclic)
15. 20mm Model 98 (1938) machine cannon	836	2,000	120

The defense of a hill

The Japanese defenses on the Pinnacle, a.k.a Hill 145 (meters above sea level), provide an example of the all-round defense of a key feature. This hill was on the southern portion of Okinawa, 1,900 yards inland from the east coast. It constituted part of the outer defenses of the main cross-island Shuri Line, and was defended by 1st Company, 14th Independent Infantry Battalion (IIB), 63rd Brigade, 62nd Division. Trench systems protected the perimeter along with no less than 21 caves, 10 occupied MG positions, and 7 mortar positions. Some MG positions on the crest, adjacent to the company command post, were connected by tunnels. Minefields, barbed wire, and pre-planned 50m × 50m 81mm mortar concentrations protected some of the more critical approaches, though mortar fire could be directed into any area. Outlying positions covered the roads to the east of the hill, but were unoccupied. Even though the defenders knew the enemy would attack from the north and that covering positions (not shown) were established on adjacent hills and ridges, the hill mass was defended by a 360-degree perimeter. A low ridge 200 yards in front of the Pinnacle limited the American ability to deliver direct fire on the hill, forced the assault units to attack out of an exposed draw, and maximized the use of short-range Japanese weapons. Such tactics can also be seen at the roadblock located on the hill's southeast side – invisible to advancing tanks until they were forced to halt, and thus exposed to flanking fire. The Pinnacle was taken by 1st Battalion, 184th Infantry Regiment, 7th Infantry Division on April 6 after a two-day fight. Frontal attacks were attempted, but the assault that carried the hill fought up the west flank draw, through the trench system and then on to the crest.





The interior of this bunker provides examples of vertical support posts, log side revetments, and roof support stringers. Steel staples were used to fasten revetting logs together.

Once most of these covering positions were destroyed, the original force could attack the main position with the second force providing covering fire.

The Japanese also established strongpoints in the form of clusters of mutually supporting positions on defensively favorable terrain. The positions and approaches would be covered by artillery and mortar fire. They usually possessed all-around defenses and fields of fire and were themselves covered from positions outside of the strongpoint. They were usually established on hills, ridges, or any available elevated ground, even if only a few feet higher than the surrounding terrain (see illustration on page 18). It was especially desirable if the ground within the strongpoint was laced with gullies and ravines to provide concealed positions and allow covered movement within the strongpoint. Such features also made it difficult if not impossible for tanks to enter the position. Trenches and tunnels were dug to allow movement within the strongpoint. Larger areas and terrain features possessing concentrated defenses were called "defended areas."

Japanese defensive firepower

A discussion of Japanese units, their weapons, and their integration into the defense is necessary at this point. Many Japanese weapons were relatively short range. The Japanese fully appreciated that Allied weapons had longer range and that heavy use would be made of artillery. Defensive positions were often emplaced on reverse slopes and in locations screened to the front by higher ground. This forced Allied assault troops into exposing themselves as they advanced over this terrain, and made it more difficult for them to employ long-range direct-fire weapons and adjust indirect fire.

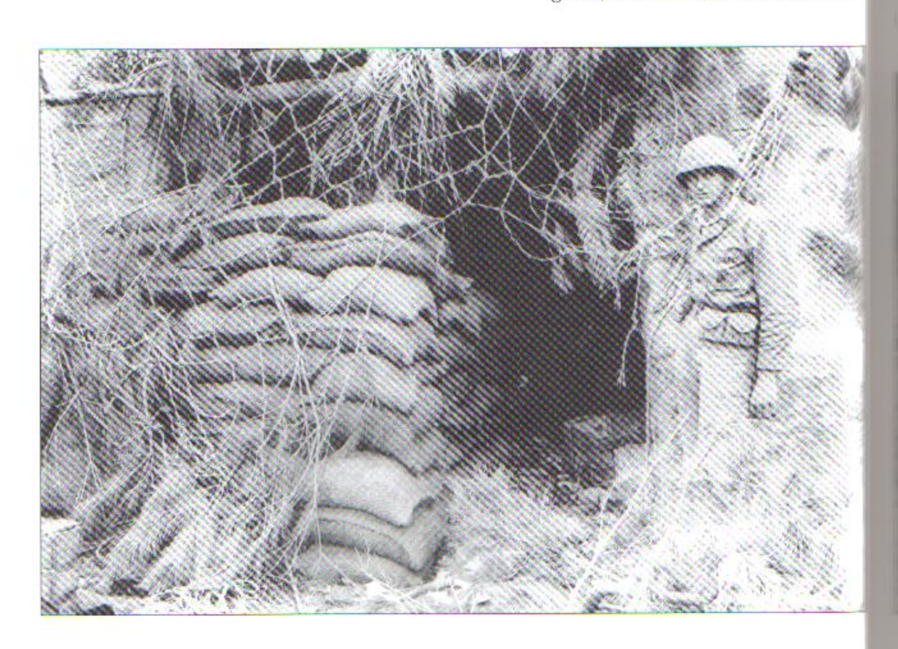
An example of the effective use of short-range fire is the fighting at Sugar Loaf Hill on Okinawa. This small, bare hillock was heavily fortified on its forward slope by tunnel-connected machine gun positions with interlocking fire. The reverse slope too had machine gun positions, connected to each other and to those on the front by tunnels, and was seamed with trenches full of riflemen, light machine gunners, and grenadiers who covered the approaches, forward slope, crest, and flanks. Marine assault companies gained the crest on at least six occasions only to be driven off with heavy casualties by the fire from the reverse slop and from adjacent low hills to its rear and flanks. It was finally secured, but eight Marine rifle companies were decimated in the process.

This LMG pillbox on Okinawa demonstrates the layered logs, rocks, and earth principle of construction. It was typical of those built on ridge sides and virtually impossible to detect until it opened fire. This one's firing port was blasted open by bazooka hits, which also blew away the camouflage. The port was originally only a few inches high. The 36in.-long M1 carbine to the port's left was inserted for scale.



While the Japanese were totally oriented to offense, infantry units were well armed with weapons complementary to defense. Japanese infantry regiment organization varied depending on when and where it was raised. A regiment could contain 3,800 to 5,600 troops depending on its strength allocation. A typical infantry regiment organic to a division consisted of:

Unit	Weapons
Regimental Headquarters with Train	
Regimental Signal Company	
Regimental Infantry Gun Company	4 × 75mm regimental guns
Regimental AT Company	6 × 37mm or 47mm AT guns
Infantry Battalion (×3)	
Battalion Headquarters with Train	
Rifle Company (×4)	(see following discussion for weapons)
Battalion Machine Gun Company	4 or 8 or 12 × 7.7mm HMGs
Battalion Gun Platoon or Company	2 or 4 × 70mm battalion guns, 0 or 8 × 20mm AT rifles



The entrance of this supply dugout on Okinawa is well protected by rice-straw sandbags, former rice shipment bags. A camouflage net, with most of its intertwined vegetation blown away, concealed the entrance.

The infantry battalions' four 180–200-strong rifle companies had a 19-man headquarters, three rifle platoons, and sometimes a weapons platoon. The 50–60-man rifle platoons had a small platoon headquarters and four sections. The three light machine gun sections (equating to a US rifle squad) had 13–15 men armed with a single Nambu 6.5mm Model 11 (1922), 6.5mm Model 96 (1936), or 7.7mm Model 99 (1939) light machine gun (LMG) plus a 50mm Model 89 (1929) or Model 10 (1921) grenade discharger. The grenade discharger section was essentially a rifle squad with two or three grenade dischargers and lacked an LMG. The 50mm grenade discharger ("knee mortar") fired hand grenades with propellant charges attached, mortar rounds, flares and smoke signals. Bipod-mounted LMGs, fed by a top-loading 30-round magazine, provided the section's base of fire and afforded close-in defense for heavy machine guns (HMGs) and other crew-served weapons. The Arisaka 6.5mm Model 38 (1905) and 7.7mm Model 99 (1939) rifles were as reliable and rugged as any bolt-action in service. Even in the close confines of defensive positions the Japanese soldier often fixed his characteristically long bayonet. He was amply supplied with hand grenades, although these were unreliable and of moderate effect. Each section normally possessed a rifle grenade launcher for firing fragmentation and smoke grenades.

The battalion machine gun company was armed with four, eight, or twelve Nambu 7.7mm Model 92 (1932) HMGs or a lightened version, the Model 1 (1941). The similar 6.5mm Model 3 (1914) was also encountered. These tripod-mounted weapons were a mainstay of sustained defensive fire. Even though fed by 30-round metallic strips, a high rate of fire could be maintained. Eight or twelve guns per battalion machine gun company were the normal allocation, with four guns per platoon. The four-gun company had two two-gun platoons. In this case other HMGs were assigned to rifle company weapons platoons, though this was not a normal fixture. This weapons platoon might also have two 20mm Model 97 (1937) AT rifles. Capable of semi- and full-automatic fire with a seven-round magazine, they were surprisingly effective against light tanks and personnel. An 11-man section manned each HMG and AT rifle. In battalions lacking rifle company weapons platoons, the eight 20mm AT rifles were assigned to four two-gun platoons in the battalion gun company allowing them to be attached to rifle companies as necessary. Few units were issued this expensive weapon though.

The battalion gun company had two platoons each with two 70mm Model 92 (1932) infantry guns (a.k.a. battalion guns): some battalions had only a single

Japanese Army artillery and anti-aircraft guns

Field artillery

The 75mm and 105mm pieces were usually found at division level while 150mm pieces and 105mm guns were in army level artillery units. Obsolete models (those pre-dating 1930) often remained in use in second-line units and fixed island defenses.

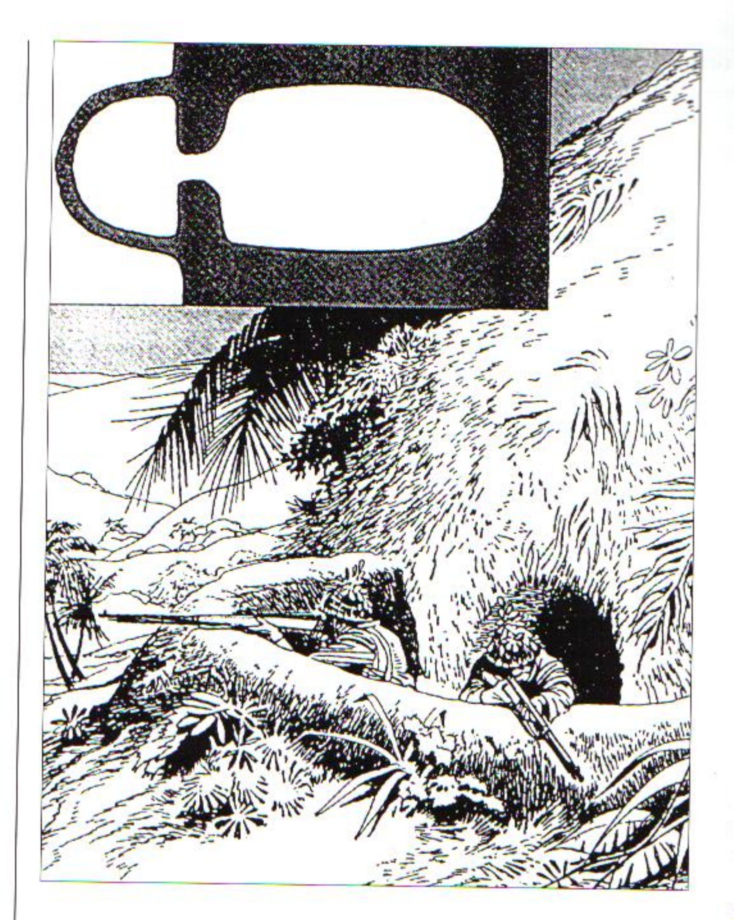
- 75mm Model 38 (1905) (Improved) field gun
- 75mm Model 94 (1934) mountain gun
- 75mm Model 90 (1930) field gun
- 75mm Model 95 (1935) field gun
- 105mm Model 38 (1905) field gun
- 105mm (a.k.a. 100mm) Model 14 (1925) field gun
- 105mm (a.k.a. 100mm) Model 92 (1932) field gun
- 105mm Model 91 (1931) field howitzer
- 150mm Model 38 (1905) field howitzer
- 150mm Model 4 (1915) field howitzer
- 150mm Model 89 (1929) field gun
- 150mm Model 96 (1936) field howitzer

Anti-aircraft guns

- 20mm Model 98 (1938) machine cannon
- 20mm Model 2 (1942) machine cannon
- 20mm Model 4 (1944) twin machine cannon
- 75mm Model 88 (1928) field AA gun (also IJN)
- 88mm Model 99 (1939) heavy AA gun
- 105mm Model 14 (1925) heavy AA gun



Narrow communications trenches on New Guinea connect pillboxes, one can just be seen in the background. Such small trenches, often covered with palm fronds, were difficult to detect from the ground and air.



Japanese foxholes were usually small, simple one-man holes, but sometimes more elaborate one- and two-man positions were constructed depending on time available. Such a position could house an LMG or grenade discharger. The actual position would be well shrouded with foliage. The inset diagram shows a plan view of the position.

two-gun platoon. This gun could deliver close-range direct fire or longer-range indirect fire. The Japanese relied on it for indirect fire support as few mortars were assigned to infantry units. Independent mortar battalions with 81mm, 90mm and 150mm pieces were non-divisional assets. The advantage of the 70mm was that it was extremely compact, making it easy to conceal and emplace in fortifications, light enough to be easily manhandled over rough terrain, and man-packed in ten loads. It had high explosive (HE), shrapnel, smoke, and less-than-effective armor-piercing (AP) rounds. Later in the war, faster and cheaper to produce 81mm Model 97 (1937) or short-barreled Model 99 (1939) mortars were issued to some units in lieu of the 70mm.

The regimental gun company possessed four 75mm Model 41 (1908) infantry guns (a.k.a. regimental guns) to provide direct and indirect fire. Comparatively compact and light, this gun could be broken down into six pack-horse loads. Like the 70mm, it was easy to conceal and to build a position for. It was provided HE, shrapnel, AP, AT shaped-charge, and white phosphorus rounds. Some regiments were provided with a regimental gun battalion (a.k.a. "unit") with two four-gun companies.

Japanese AT guns were of outdated and ineffective design. There was little serious armor threat in China and even though the Japanese had faced Soviet armor in Manchuria in 1939, they had been lured into a false sense of security when their (even then) outdated 37mm guns managed to destroy some obsolescent Soviet T-26 and BT-series light tanks. Nonetheless the Japanese were defeated by the Soviet ability to rapidly maneuver cross-country supported by armor. The Japanese also believed that the use of armor would be limited on Pacific islands and that the Americans could only employ light tanks. This was true through late 1943 when only US M2A4, M3-series, and M5 light tanks were employed. The November 1943 Marine assault on Tarawa saw the first use of the M4 Sherman medium tank: from that point onwards, the Japanese had only limited capacity to defeat US armor. The 75mm gun and 105mm howitzer-armed M4-series Sherman tanks, 105mm M7 Priest self-propelled howitzers, M3A1 halftrack-mounted 75mm guns, 3in. M10 Wolverine and 76mm M18 Hellcat tank destroyers, and various flamethrower tanks proved to be difficult to stop with available AT weapons. M5A1 light tanks continued in limited use in a support role. In 1945 on Okinawa the causes of US tank losses were mines, AT guns, artillery, and suicide attacks with magnetic hand mines and satchel charges – in that order.

The principal Japanese AT gun was the 37mm Model 94 (1934) infantry rapid-fire gun. Originally intended to deliver direct fire on machine guns, it was provided with HE ammunition. Even though an armor-piercing (AP) round was issued, it performed dismally as an AT gun owing to its low velocity and poor penetration. It could knock out a US light tank with multiple hits, but the Sherman was impervious. Aware that the Model 94 was inadequate, the Japanese produced a limited number of the 37mm Model 97 (1937) guns, a copy of the German Pak.35/36. From late-1942 the 47mm Model 1 (1941) AT gun began to appear. While not as effective as similar contemporary weapons,

An elaborate LMG position with three firing ports. While the position covered a wide sector of fire the weapon had to be moved from embrasure to embrasure to cover it. This position's roof is lightly constructed. More typical would be two to four layers of logs and perhaps a layer of rocks.

it could knock out a Sherman, but not always with a frontal shot. This shortcoming though did not hinder the Japanese as they strove to emplace AT guns in well-concealed flanking positions. Besides AP projectiles the 47mm had an HE round allowing it to serve as an anti-personnel weapon. The regimental AT company had three two-gun platoons. Even late in the war these were still often armed with 37mm pieces. Most 47mm guns were found in non-divisional AT battalions.

Besides the significant organic firepower (albeit lighter than delivered by US divisions) Japanese units were augmented by non-divisional assets in the form of independent machine gun, mortar, AT, and machine cannon battalions. Machine cannon units were armed with 20mm Model 98 (1938) machine cannon and 13.2mm Model 93 (1933) HMGs. Both were capable of marginally effective AA and AT fire, but were especially effective as anti-boat and anti-amtrac guns. All of these non-divisional, regimental, and battalion-level weapons were attached down to company-level, causing quite a thickening of the line in the way of firepower.

Besides three-regiment infantry divisions, the Japanese employed independent infantry and independent mixed brigades with anything from three to eight independent infantry battalions. Mixed brigades were augmented with organic artillery, engineer, and minimal service units. While intended as garrison and rear area security forces, they were frequently pressed into manning defenses alongside divisions.

For the most part the Japanese squandered their few tanks committing piecemeal and poorly timed massed armor counter-attacks, too late to have any impact on initial landings: these were easily defeated by the Americans. More frequently they dug-in their 37mm gun-armed Model 95 (1935) Ha-Go light

Japanese Navy coast defense and anti-aircraft guns

Coast defense guns

Most of these were of standard naval design intended for deck mounting on steel pedestals aboard ships. They were issued to guard forces and emplaced on concrete and/or timber mounts. These and other shipboard guns were often recovered from grounded ships and emplaced as coast defense guns. The more modern dual-purpose guns could engage both surface and aerial targets.

- 100mm Model 98 (1938) twin dual-purpose gun
- 120mm Model 3 (1914) gun
- 120mm Model 10 (1921) dual-purpose gun
- 120mm Model 11 (1922) dual-purpose gun
- 127mm Model 89 (1929) twin dual-purpose gun
- 140mm Model 3 (1914) gun
- 200mm Model 3 (1943) short gun
- 200mm Vickers Model 38 (1905) gun (British-made)

Anti-aircraft guns

Besides being mounted aboard ships, the 80mm (actually 76.2mm) gun was also provided with a mobile mount for land use. The others were originally shipboard weapons mounted on steel pedestals fitted to timber and/or concrete foundations.

- 25mm Model 96 (1936) single, twin, triple AA guns
- 40mm Model 91 (1931) AA gun
- 40mm Model 1 (1941) twin AA gun
- 80mm Model 3 (1914) AA gun

and 57mm gun-armed Model 97 (1937) Chi-Ha medium tanks, the most common models, in hull enfilade revetments for employment as pillboxes. They were seldom actually buried though as it was still desirable for them to be mobile. Japanese tanks found buried up to their turrets on Guam led to speculation as to why by postwar newspapers. The reality is that they had been emplaced in open revetments with entry/exit ramps. Rain eroded the sand parapets over the years, filling the emplacements. Often criticized for what many deem to be an inappropriate use of armor, it was probably the most effective means of employing them, considering their small numbers, their vulnerability, and overwhelming US firepower.

A bewildering mix of weapons was encountered on many islands, especially with regard to artillery and AA guns. As the Allies approached closer to a region, its islands were greatly reinforced. New units arrived to supplement the garrison and with them came different allocations of weapons. Additional weapons, sometimes obsolete, were sent from depots aboard supply ships sailing from island to island. Crews to man them were drawn from existing units augmented by service troops and they were incorporated into the defense. Once the Allies landed there was little service troops could do to support operations. Ammunition, rations, and water had been stockpiled in positions as movement in the open was virtually impossible. Caches of weapons, ammunition, medical supplies and rations were often hidden about islands in bunkers and dugouts. Up to six months of supplies were stocked on most islands. While a few small service elements were retained, most were reorganized into rifle battalions with few if any crew-served weapons. In some instances otherwise unarmed Korean, Okinawan, and Formosan laborers were armed and told to fight the Americans to the death. Many did, but the few prisoners taken were mainly laborers. These units defended coastal areas in the rear to prevent additional landings, secured flanks, prepared and often manned additional lines of defense, thickened the frontline by attachment to divisions and brigades, and were used as a source of replacements for frontline units. The Allies were often astonished at how the Japanese rebuilt shattered units by feeding in service troops. All Japanese soldiers were taught to be riflemen first and then were only required to defend a position to the death.

The IJN possessed a significant Land Force involved in island defense. Base Forces provided command and service elements to operate naval bases. Guard Forces or Defense Forces of varied size defended naval bases. No two were organized the same and they manned varied numbers of coast defense, AA, and infantry-type crew-served weapons. Special Naval Landing Forces comprised hand-picked sailors trained in infantry tactics. They were responsible for seizing numerous islands early in the war. SNLFs were initially large battalions trained in amphibious landings, but it is incorrect to refer to them as "Imperial Japanese Marines." After Japan lost the operational initiative, the SNLFs were transitioned to island defense units with up to 2,000 men manning light coast defense, AA, AT, and crew-served infantry weapons. All had a varied number of large rifle companies and some possessed light tanks. Many of the weapons were the same as used by the IJA, but they made extensive use of single and twin 13.2mm Model 93 (1933) HMGs in the AA and anti-boat roles as well as a few other unique weapons.

Construction materials

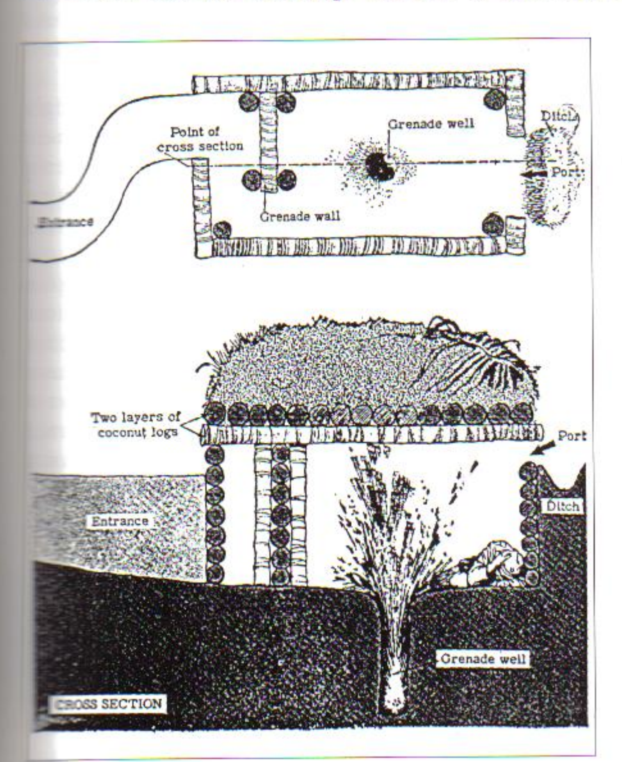
The Japanese made extensive use of local materials to construct fortifications and obstacles; it was often all they had. Issued construction materials were insufficient and went to priority installations such as command posts, communication centers, and coast defense gun positions. The use of local materials was also caused by shortages of concrete and steel that were diverted to fortifications in the Home Islands and Mandated Territory. Also, shiploads of material and equipment en route to the islands were sunk by Allied aircraft and submarines.

Abundant on most islands, coconut logs were an ideal construction material. Relatively easy to cut down, the interior is soft and fibrous making them resilient to the impact of projectiles, thus reducing splinter wounds. With age though, coconut logs became spongy, were easily penetrated by projectiles, and lost their ability to support heavy loads. Among the few issued construction items were large steel staples or cleats of varied size: these were hammered into the ends of logs or into the sides of adjacent logs to provide a more solid structure.

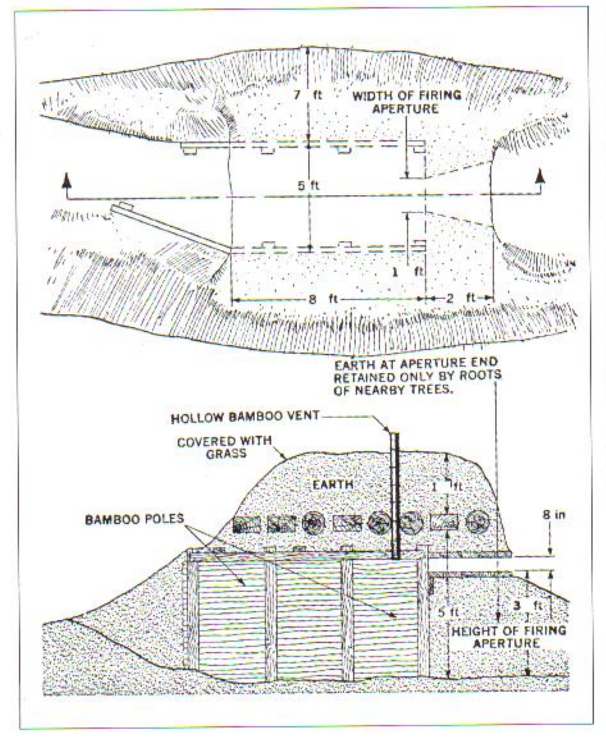
Numerous species of hardwood trees were found on the larger islands and used for fortification and obstacle construction. Ironwood (Casuarina) was common, providing a difficult to work but exceptionally tough material (it is so dense that a log will not float). Dimensioned lumber was a scarce commodity and most of what was shipped to the islands was used for barracks, warehouses, piers, and other frame structures. In some instances, on the larger islands with hardwood trees, the Japanese shipped in portable sawmills.

Like all other armies the Japanese shipped munitions, rations, and other matériel in robust wooden boxes and crates of all sizes. These were often filled with sand and stacked brick-like to form interior walls in fortifications. They were braced by logs or timber or bound together by wire to prevent their collapse when the fortification was struck by artillery. Boxes were also disassembled and the boards used to construct firing ports, doors, shelves, etc. Nails removed from disassembled boxes were a valuable commodity. Wooden kegs and steel fuel and oil drums were readily available. Like boxes they were filled with sand and incorporated in bunker walls either set upright or stacked on their sides. Oil and gasoline drums sometimes had the ends removed, and were then cut lengthwise and flattened to provide a sheet of metal for revetments or roofing. Drums with the ends removed were laid end to end in trenches and the trench backfilled to create crawl tunnels connecting positions.

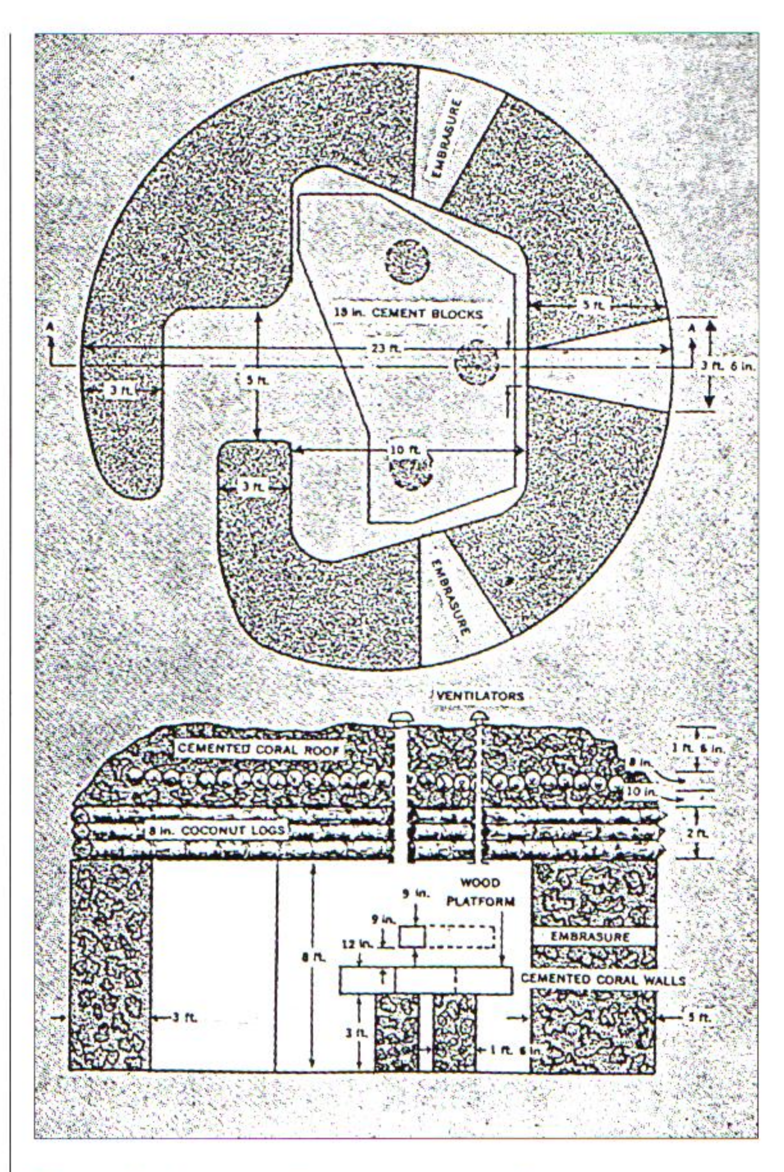
Rice and other food grains were shipped in burlap or durable rice-straw bags, and these were reused as sandbags. Few purpose-made burlap sandbags were issued. Rice and issue sandbags were tan to light brown in color. Two layers



BELOW LEFT This rifleman's position demonstrates six means of protection from grenades: overhead cover, a small embrasure, a ditch to catch rolling grenades (also to prevent debris from blocking the port), an angular entrance trench, an interior wall to block grenades and blast, and a well in which to kick grenades and which also served as a sump to collect water.



BELOW RIGHT This large rifle position on Luzon was revetted with bamboo and planks. The embrasure was made of planks and timbers reinforced the roof. The bamboo vent through the roof helped keep the position clear of weapons' fumes.



This type of coral masonry pillbox was encountered on Peleliu and Okinawa. The side wall was 3–5ft thick, but sloped outward at the base (the diagram depicts them as vertical). The roof was built up of layers of logs capped by coral and cement. A woodern platform on coral masonry supports was provided for the LMGs. (See illustration on page 27.)

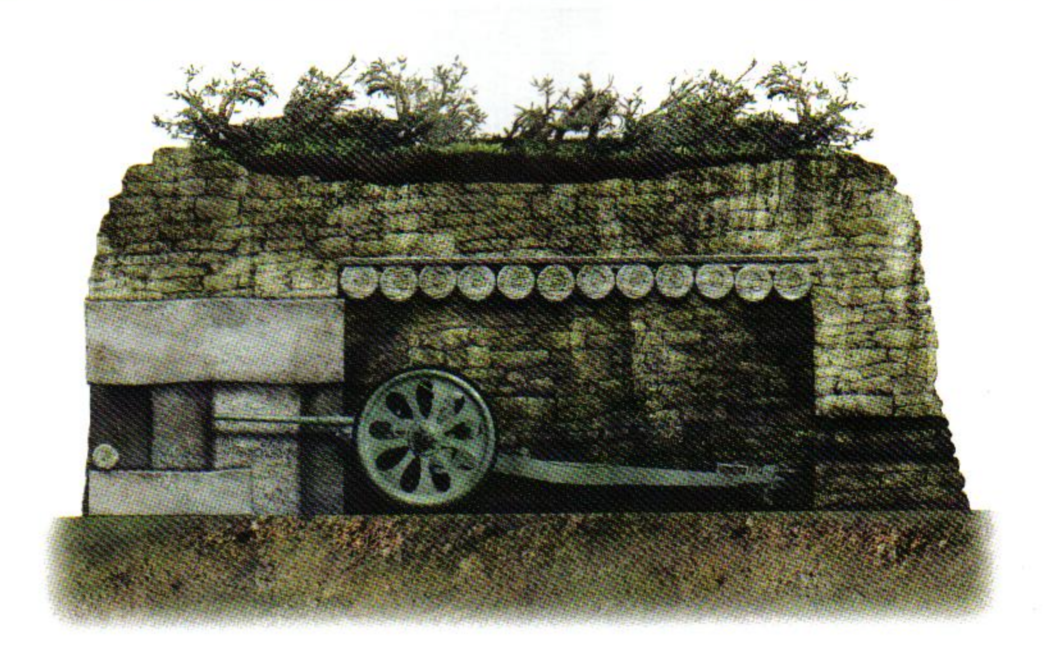
of sandbags were sufficient to stop small arms fire and provide protection from mortars.

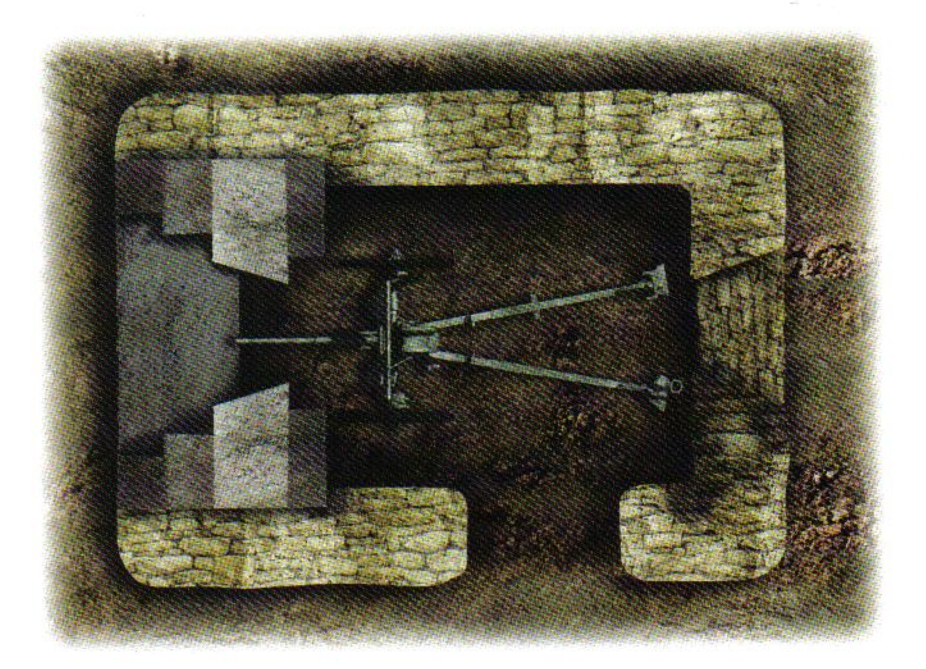
Regardless of the materials that the fortification was made from, large amounts of coral or volcanic sand were piled on top. Loose sand absorbs AP projectiles and the blast and fragmentation of HE to provide a cushioning effect. Coral sand, usually white or tan, is moderately adhesive, especially when wet. Volcanic sand, ranging from brown to black, has little adhesive property: when a hole is dug the sand slides easily back into it. The sand covering also served as camouflage and was usually contoured to blend the fortification into the surrounding ground. Coral and limestone rock, in blocks and large fragments, were mixed into the covering layer of sand to break up projectiles or stacked in layers to serve as a shell-bursting material. Coral rock is flat and layered and has the consistency of limestone, and neither of these shatters easily.

Corrugated sheet metal was mainly used as roofing for wood-frame structures and aircraft hangars. Some was used for revetments. Once Allied air strikes began on islands and many of the support structures were destroyed, sheet metal was recovered and incorporated into fortifications.

Cement was shipped in watertight 50kg sheet metal cans. Coral or volcanic sand and gravel were added to make concrete. If gravel was not available, crushed seashell or pulverized coral rock was used. Rock crushers were shipped to some islands. Low-grade steel reinforcing bars (rebar), 10–19mm in diameter, were used to the extent supplies permitted. Most cement was reserved for command posts, communications centers, fuel and ammunition storage bunkers, other critical support facilities, and seaplane ramps. What cement was allotted to field fortifications was used for some pillboxes covering critical areas, but often only the frontal portion of a position might be concrete while the rest was made of local materials. Small cave openings were often provided with concrete walls with firing ports, making these very tough to take out. Cement was prioritized to islands were other suitable local materials were unavailable, and to islands in the inner defense zone (the Marianas, Marshalls, Carolines, Palus, Iwo Jima, and Okinawa).

Lead and iron pipe was used for water lines, but after air strikes began salvaged pipe was used in fortifications, mainly for anchoring revetments and reinforcing roofs. The Japanese constructed narrow-gauge (60cm/24in.) railroads on many islands to haul agricultural products, phosphate, or military supplies. Allied air attacks demolished these lines and the rails were used to reinforce fortifications, especially as roof beams.

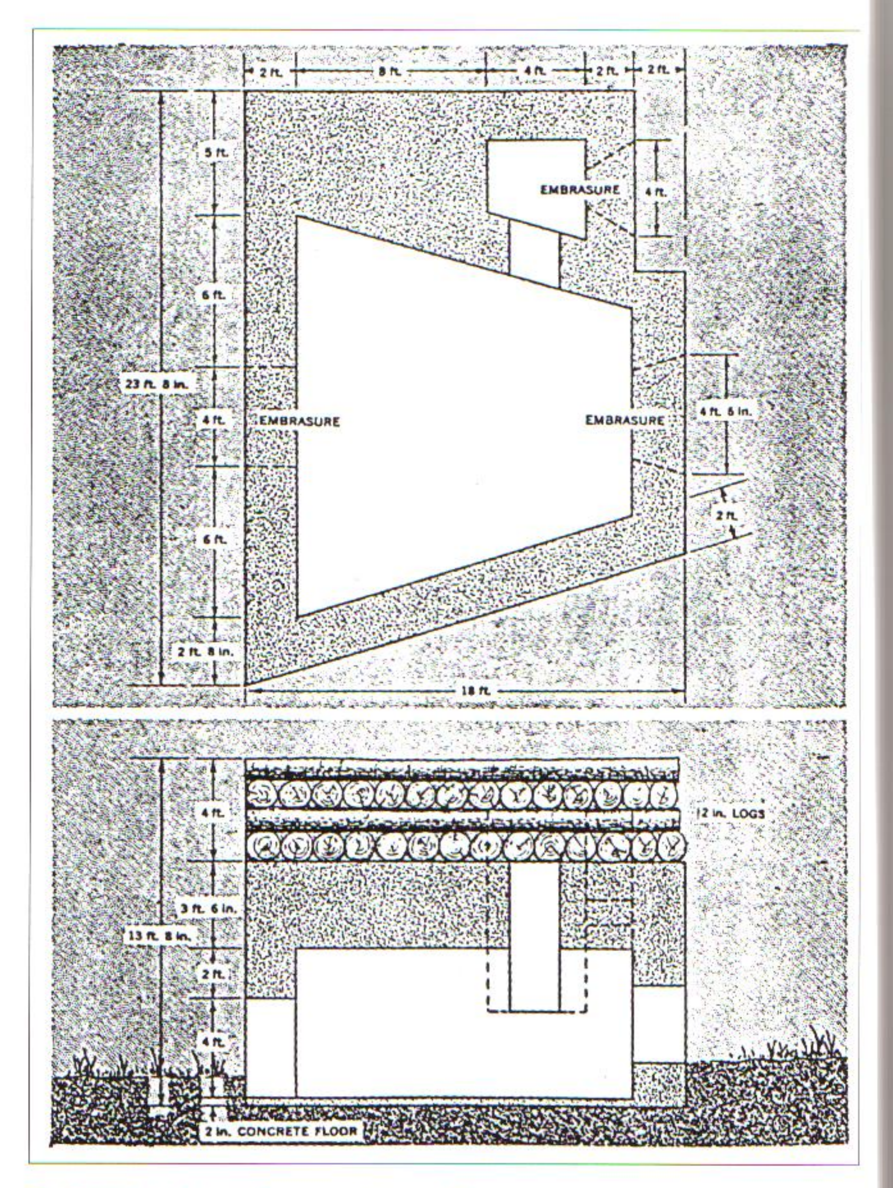




Antitank gun casemate

AT guns were provided with robust protection, knowing they would be subjected to heavy fire. This type of position, used from 1944, was built at ground level. It had a 6ft-thick reinforced concrete front with a stepped embrasure. The side and rear walls were 3ft thick and made of concrete-bonded coral rock. An entrance, large enough for the 37mm Model 94 (1934) AT gun, was located in the side and an LMG embrasure protected the rear. The ceiling comprised 6–9in. logs topped with corrugated sheet metal on which 3–5ft of cement and coral rock was laid. The poured concrete gave the casemate the appearance of having been "melted." Vegetation was planted on the roof and around the casemate. Up to 100 rounds of ammunition could be stowed in ready racks within such a position.

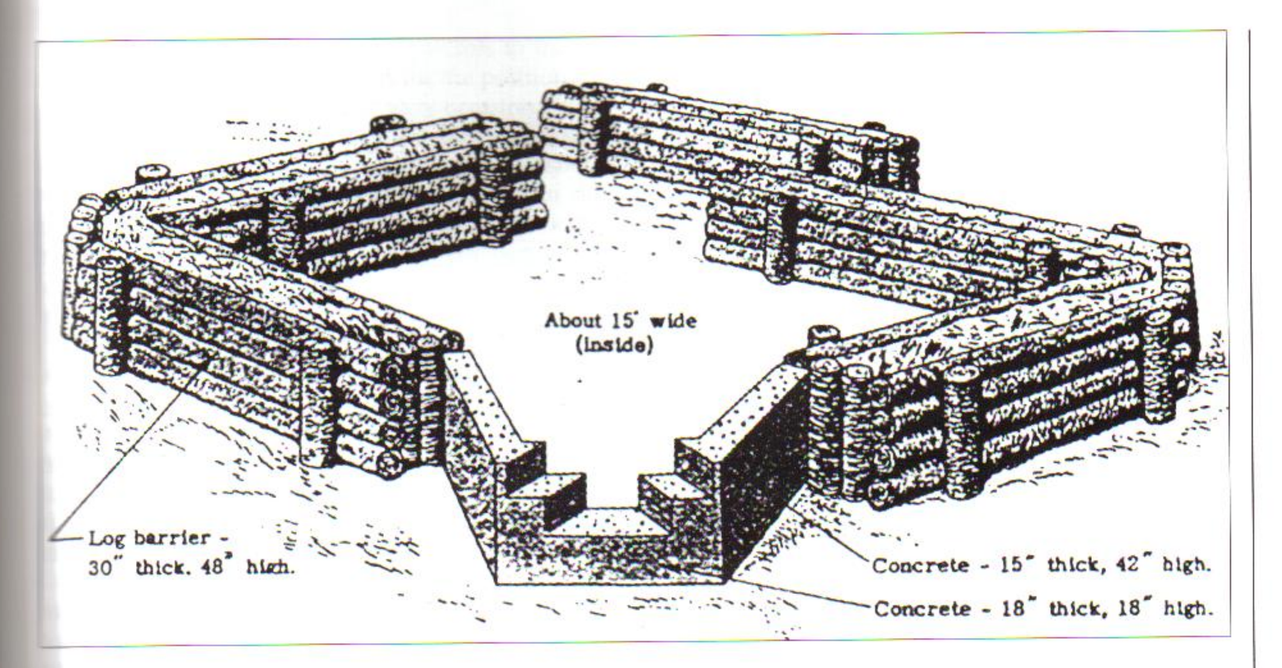
This concrete casemate housed a 75mm Model 94 (1934) mountain gun. The gun was disassembled to move it into the casemate. Mountain guns and other light artillery had wide split trails as demonstrated by the casemate's shape. This casemate had a side position for the gun chief from which he could observe and direct fire without his vision being restricted by the gun's smoke and dust. This practice was encountered on Peleliu and Okinawa. Its roof was additionally reinforced by 4ft of logs to provide an effective artillery-burster layer. The entire casemate would be covered with sand and camouflaged.



Principles of construction

In common with other armies, the Japanese had developed a defensive doctrine along with prescribed principles and methods of construction, many based on British World War I manuals (though as noted local adaptation was common). For the most part defensive positions were dug as deep as possible and kept low to present a low profile. This was not always possible because of high water tables, swampy ground, or shallow bedrock; or because the roof had to be thick to protect from heavy artillery fire; or because the position's firing port had to be set higher in order to cover its field of fire effectively, especially if firing downhill. Positions dug into the sides of hills, ridges, gorges as well as cave positions were usually built flush with the surface making them difficult to detect if well camouflaged with foliage or rocks.

Unless made of concrete, interior walls were built of logs, planks, sand-filled boxes or drums, sandbags, or some form of shoring to prevent collapse when hit by artillery or bombs. Positions built of rock were sometimes lined with a layer of sandbags to prevent flying rock fragments. Rock pillboxes had to be shored with logs as they could easily collapse. We know of some instances



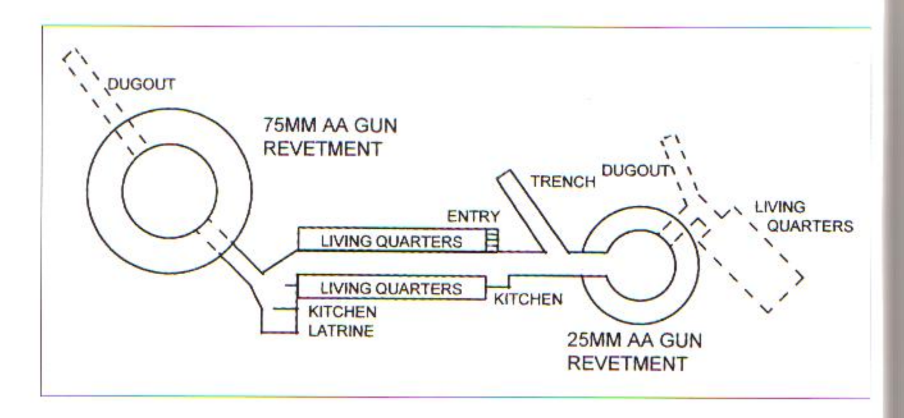
This open-topped AT gun position encountered on Makin Island had a low concrete wall in the front with a firing embrasure. The position's sides were protected by double coconut log walls filled with sand between them. It was built at ground level with no part of the emplacement below ground.

where pillboxes were built of stacked coral stones. Once roofed over, concrete was poured over the structure and allowed to run down the sides to form a concrete cap (see illustration on page 27). Concrete parapets for some large, open-topped coast defense and AA gun positions were constructed by building a wooden structure in the desired angular shape, stacking layers of coral stone, pouring concrete over each subsequent layer, and then pouring more into the form to give its sides a finished appearance. Even though built without rebar, such positions were quite robust.

Most pillboxes, bunkers, and other positions were built of coconut or hardwood logs, laid horizontally or dug-in vertically. Horizontal log walls were



This 75mm Model 2 (1942) self-propelled gun was positioned in a timber revetted casemate dug into the side of a hill. However, 4.5in. barrage rockets blew away the position's front half.



An AA gun position on Kiska Island in the Aleutians for a 75mm and a twin 25mm AA gun. Living quarters were either underground or heavily sandbagged bunkers adjacent to the connecting trench. Ready ammunition racks were in the sides of the gun revetments.

supported by vertically-piled logs with the ends often held together by steel staples. Wire and cable were sometimes used to lash logs together. Gaps were left between horizontal logs for firing ports or alternatively a section was cut out. Open-topped fighting positions often had similar log walls to reinforce the sides and prevent collapse from a near miss.

Concrete pillboxes, walls for cave openings, and other concrete structures contained as much rebar as available. Even wire and rope were used for reinforcement. Wooden frames were put in place and concrete poured into them: they were also used to shape firing ports and doors, and were reused before being taken apart and incorporated into other fighting positions. Close examination of these fortifications reveals that the Japanese were not always adept at pouring concrete: seams can be detected between different batches along with air voids, weakening the structure. The failure to overlap and tie-in rebar connections, the use of crushed coral or shell rather than gravel, a high water-to-cement ratio and the use of seawater also made for low-density and weak concrete. Typical compressive strength of Japanese concrete was 0.180kg/m^2 while US military concrete standards were twice that. Firing tests on Kwajalein pillboxes revealed that the US 37mm AP round penetrated 785mm (31in.) of Japanese concrete, but only 457mm (18in.) of US-standard concrete. The US 75mm AP round penetrated 1,060mm (42in.) of Japanese concrete, but only 609mm (24in.) of US concrete.

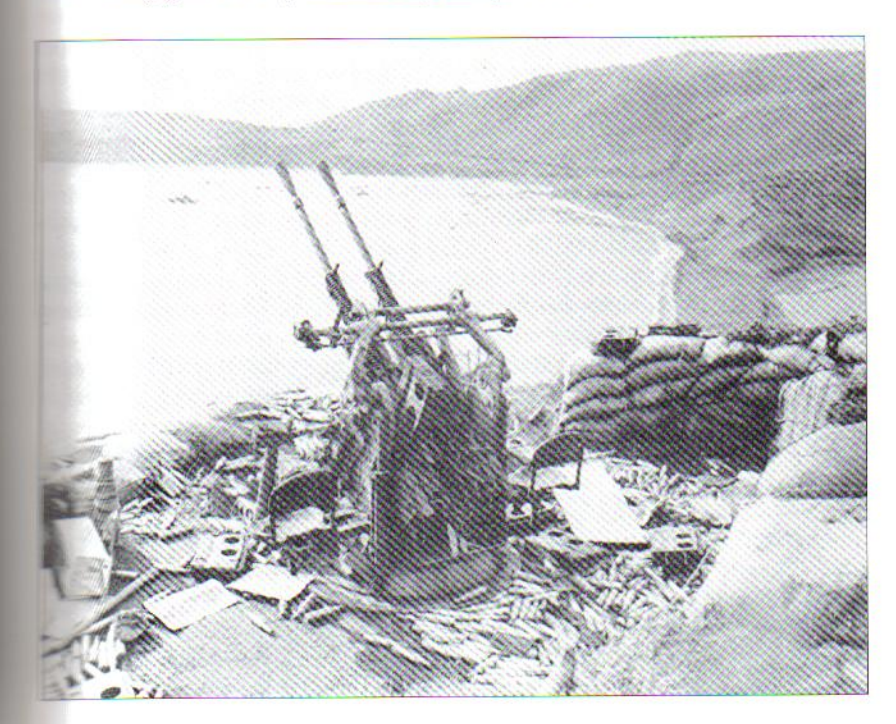
Overhead cover of fighting positions was critical to provide protection from naval gunfire, artillery, mortars, aerial rockets, and bombs. Log roofs were laid in solid layers with alternating layers perpendicular to the others. Occasionally the log layers were laid in the same direction. Anywhere from one to six layers of 4–18in. diameter logs could be used, but two or three layers were the most common. Different-sized logs might be used in each layer and rocks may have been placed between some layers as a burster layer to detonate projectiles or deform AP rounds. Even green coconuts were used for this. Between the layers of logs and rock sand or earth was placed. If available the position had corrugated sheet metal placed between layers to provide protection from rainwater. In larger bunkers and covered positions vertical support logs were necessary to shore up the roof. Stinger logs, beams, or rails supporting the roof were usually positioned 2–3ft apart. More sand or earth was piled over the position and banked against the sides. This created a significant hillock, but it was often contoured to blend into the surrounding terrain and camouflaged. US 60mm mortars did not possess the power to penetrate most bunkers. US 81mm heavy HE rounds and the 4.2in. mortar were more effective.

Firing ports were located to cover the position's assigned sector of fire, and placed very low (if not flush) to the ground. A small ditch might be dug immediately in front of the firing port. This prevented falling debris from blocking the port as well as making it more difficult for grenades to be rolled in. Some positions had only one firing port, others had additional ports to

cover wider areas or supplementary sectors to the flanks and rear. Sometimes there was a single large firing port for the position's main weapon and smaller ports for rifles and LMGs. These were occasionally positioned to the side and higher than the main port so that a soldier could spot targets and direct the fire of the main weapon, if the crew had their vision obscured by smoke and dust. Firing ports were typically small to make them difficult to detect and hit, though size affected the weapon's field of fire: occasionally, wider ports were created to allow a weapon to cover a large sector. Plank or log closures were sometimes provided for firing ports in an attempt to block fire: steel shutters were rare, the few examples being in concrete pillboxes.

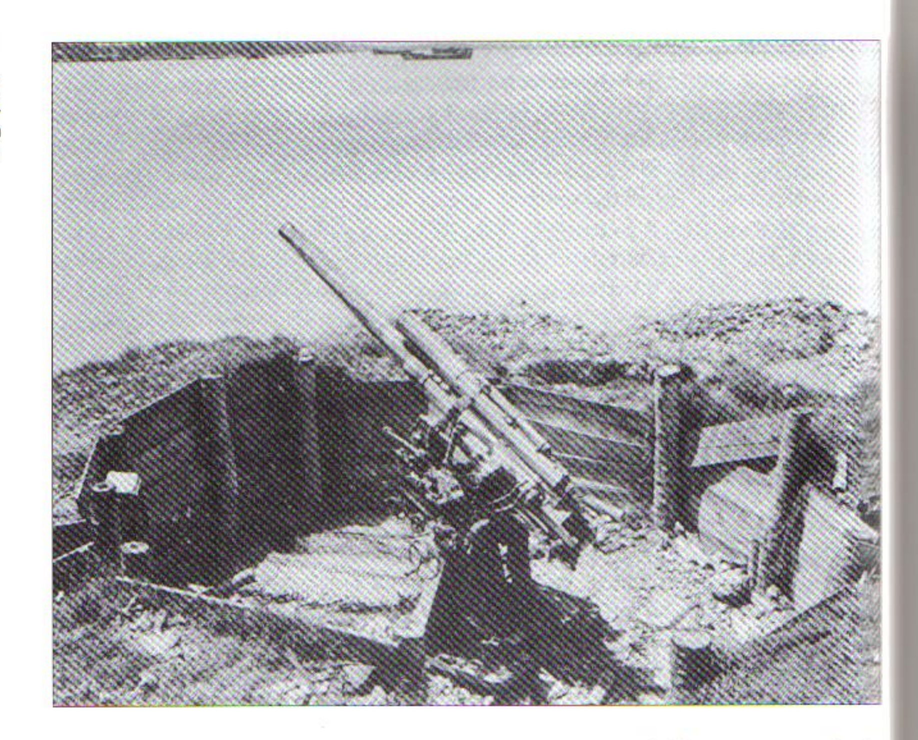
The width of a firing port was determined by the field of fire the position was assigned: the height of the opening though was usually kept as narrow as possible. Firing ports were of two basic types. The most common had a wide outer opening with a smaller inner opening. This allowed a weapon pivoting on a fixed mount a wide traverse. The disadvantage of this type of port was that its larger outer opening was easier to detect, presented a large target, and allowed bullets striking the angled sides to ricochet into the position. Wood embrasures sometimes absorbed bullets, but some could still find their way in. Concrete embrasures could be constructed in a "stepped" manner, which helped deflect bullets. The second type was built in the opposite manner, with a small outer opening and a large inner aperture. This allowed non-fixed weapons (such as rifles and LMGs) to be traversed by the firer shifting his position, and the opening was more difficult to detect.

Entrances to positions were of course normally in the rear, but in some instances they might be on the side of a position, depending on the protection and concealment afforded by surrounding terrain. Entrances were often protected to prevent direct-fire, blast, fragmentation, grenades, demolition charges, and flamethrower fire from entering: this might be a blast barrier inside the position or a similar barrier or wall on the outside. Entry may have been gained by a trench or tunnel with one or more right-angle turns. Many positions though had only a straight, unprotected entryway. Doors were seldom provided other than on some concrete fortifications. This often proved to be the weakest point of attack as they were usually protected by fire from adjacent positions.



Despite the fact that this 25mm Model 96 (1936) twin AA gun was protected only by a modest sandbag berm and placed in a rather exposed position, it obviously survived long enough to make its presence felt. This position was sited for both AA and anti-boat defense.

This is one of four 80mm Model 3 (1914) AA guns sited on the lagoon side of Butaritari Island, Makin Atoll. This plank-and-log revetted position is typical for AA guns sited for both AA and anti-boat defense. Ready ammunition was stowed in side trenches.

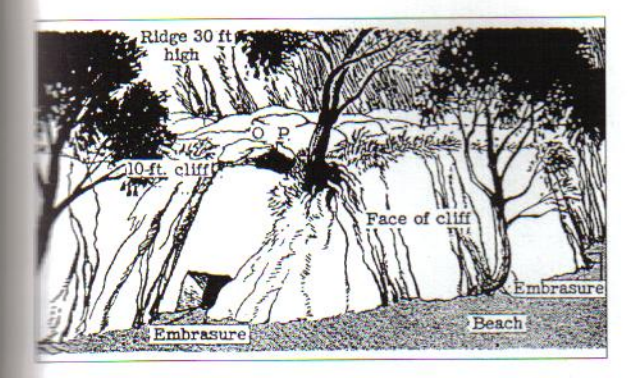


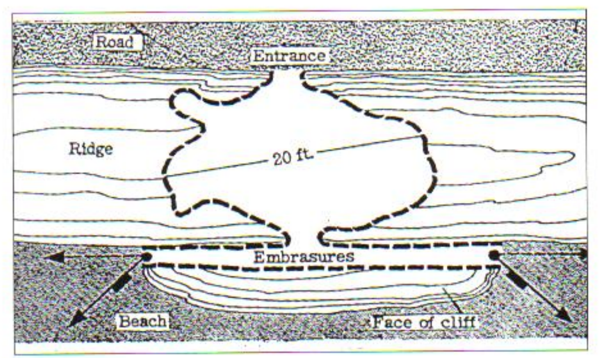
Some positions were built as two-story structures with firing ports on both levels covering different areas. Often only the upper level had a firing port and the lower provided shelter for the crew when receiving heavy fire. The troops manning the weapon could duck into the lower level through a hatch and possibly survive a demolition or flame attack. Larger positions were often compartmented as well. An interior log wall separated the weapon firing position from the rear portion where ammunition was stored. It also offered the crew some protection from explosions and flames entering through the embrace. If there were two or more crew-served weapons in a bunker they were separated by a wall so that explosives thrown through one port would not knock out the other weapon(s). In larger positions the rear compartment also served as living quarters. Often a well-protected bomb shelter lay to the rear connected by a short trench or tunnel: this might double up as living quarters.

Grenade wells were sometimes dug in the floor of covered positions. If a grenade was thrown in there may have been time to kick it into the deep but narrow hole. This also served as a drain water collection sump.

Types of positions

Trenches were widely used as fighting positions and for communication. Fighting trenches though were found to be too vulnerable to enemy fire, too easily detected, and relatively easy to attack with grenades, mortars and flamethrowers. The Japanese found that numerous, small, scattered fighting positions, be they foxholes or sophisticated pillboxes providing mutual support, were more difficult for the enemy to detect and defeat, especially in heavy vegetation or broken terrain where cover and concealment allowed the enemy to move in close. There were instances in the Philippines where officers schooled in outdated defensive concepts established intricate trench systems on close terrain only to find that they were easily overrun. Japanese manuals still addressed complex, in-depth trench systems as used in World War I. Nonetheless, fighting trenches were still used in open terrain and on the reverse slopes of hills. These were usually short segments of trench interconnected with and covered by other trenches and positions, rather than large, elaborate World War I-style complexes. Some had parapets depending on





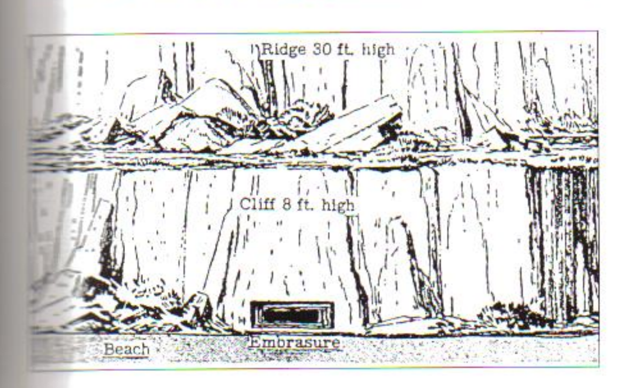
Caves were often improved upon by the defenders. The coast of Biak Island, off the northwest coast of Dutch New Guinea, was riddled with small caves along ridges. From the caves the Japanese would cut small tunnels through to the seaward side of the ridges for machine gun embrasures.

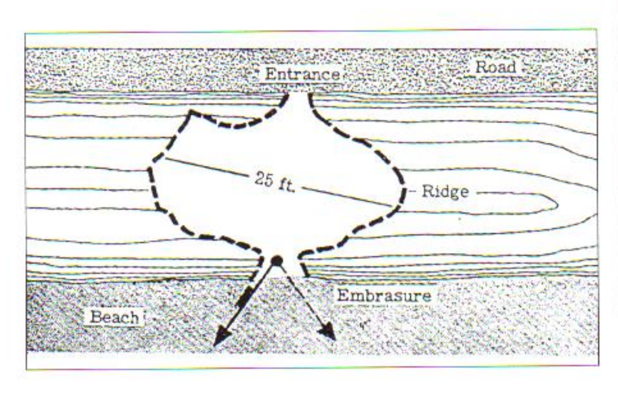
the need for concealment, as well as firing niches or individual foxholes, dug just forward of the trench and connected by short crawl trenches.

Communication trenches allowed movement between positions within a defended area. This allowed for the relocation of troops to threatened sectors, shifting weapons to supplementary and secondary positions, ammunition re-supply, casualty evacuation, and covered withdrawal – the Japanese did not always fight to the death. Japanese manuals prescribed communication trenches to be 2ft wide and 4ft deep for one-way movement and 5ft deep for two-way traffic (troops had to crawl over each other in the narrow trenches). Communication trenches could be less than 2ft deep and 18in. wide if connecting minor positions. Parapets might be present, but more often than not the earth was removed for better concealment. Communication trenches might be roofed with palm fronds, tree limbs, camouflage nets, planks, small logs, or sheet metal covered by a layer of earth, more for concealment than protection.

Trenches may have been laid out in a zigzag pattern with angular jogs, in curvy lines following terrain contour, or echeloned at right angles allowing one section of trench to cover another from the rear. The angles and curves in trenches prevented the enemy from firing down a long length of trench and reduced the damage by an artillery, mortar, or bomb hit. In loose and unstable soil revetting was required to shore up the side of the trench. Even in hard, stable soil this helped prevent the sides from collapsing. Revetting materials included saplings and branches woven through vertical support stakes, sheet metal, planks, and sandbags: sometimes smaller stakes were driven into the ground several feet from the trench and secured by taut wire to the long vertical stakes supporting the revetments.

Japanese foxholes were merely simple holes dug as deep as time allowed. Prone and kneeling positions were dug shallow in haste, but planned defenses were deeper. Sheltering one to three riflemen or an LMG crew they were dug sufficiently deep to allow soldiers to fight standing, a practice the US Marines adopted on Guadalcanal. There were no fixed sizes for individual foxholes: they could range from 1.5–3ft in diameter and 3–5ft deep. In some instances fuel





Another type of cave encountered on Biak had the embrasure cut through the limestone to provide a near water-level field of fire. The existence of so many cave positions was unexpected and it required from May 27 to July 25, 1944 to secure the lodgment area. It had been expected that it would be secured in a week.

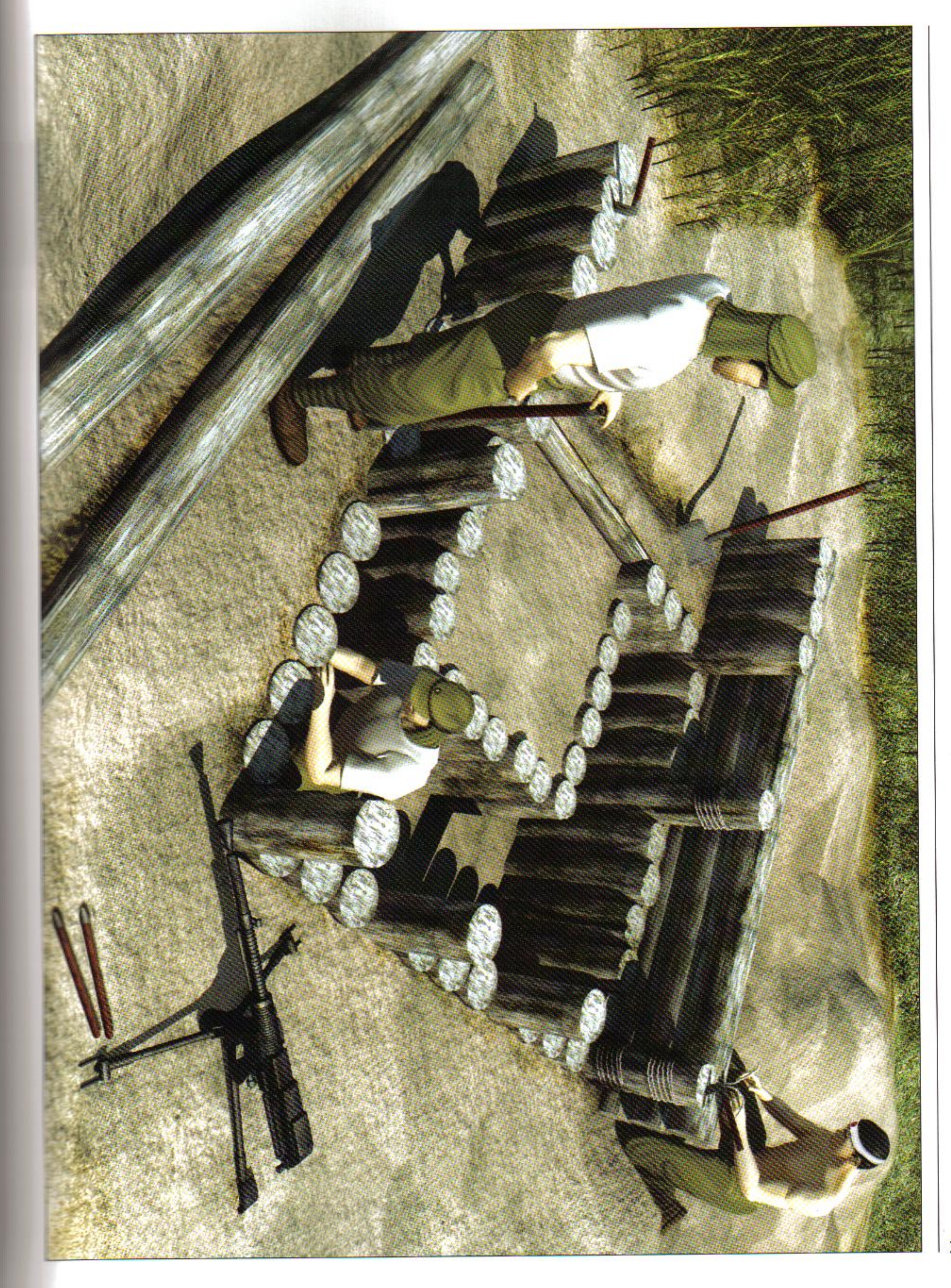
drums were dug in to revet the sides. Excavated soil was usually removed and the hole well camouflaged. If dug on a hillside though, the earth might have been built up on the front to provide a level parapet. Those built for beach defense were sometimes revetted with coconut logs, planks, or sheet metal. Sometimes a lid of woven branches and vines was employed. It was extremely difficult to detect, especially in areas covered by grass, prostrate vines, and brush. These were named "spider-holes" or "spider-traps", after the trapdoor spider. Foxholes, interspersed with machine gun and AT gun positions, might constitute the main line of defense, or could be more widely spaced to protect a flank or screen a secondary sector. Such foxhole "lines" were situated at irregular intervals in a dispersed configuration making it difficult to identify a pattern. Foxholes were widely used to protect machine gun and other crew-served weapon emplacements. Cave positions could also be protected by scattered foxholes. The attacking enemy would be fired on from multiple directions at different ranges, even from their rear. Some foxholes were positioned to cover more than one crew-served weapon and even other foxholes.

Open LMG positions were usually a simple two- or three-man foxhole. If a parapet was present the earth was piled about 3ft to the front of the hole and 6–9in. high to provide a ground-level platform for the bipod-mounted weapon. When there was no parapet for camouflaging purposes a 6–9in.-deep, 3ft firing shelf was dug on which to place the gun. The Japanese fully realized the value of such a simple weapon and often went to great effort to protect LMGs with overhead cover (from a layer of saplings and earth to several feet of layered logs and rock) and by connecting them to other positions by communication trenches. Multiple firing ports were sometimes provided.

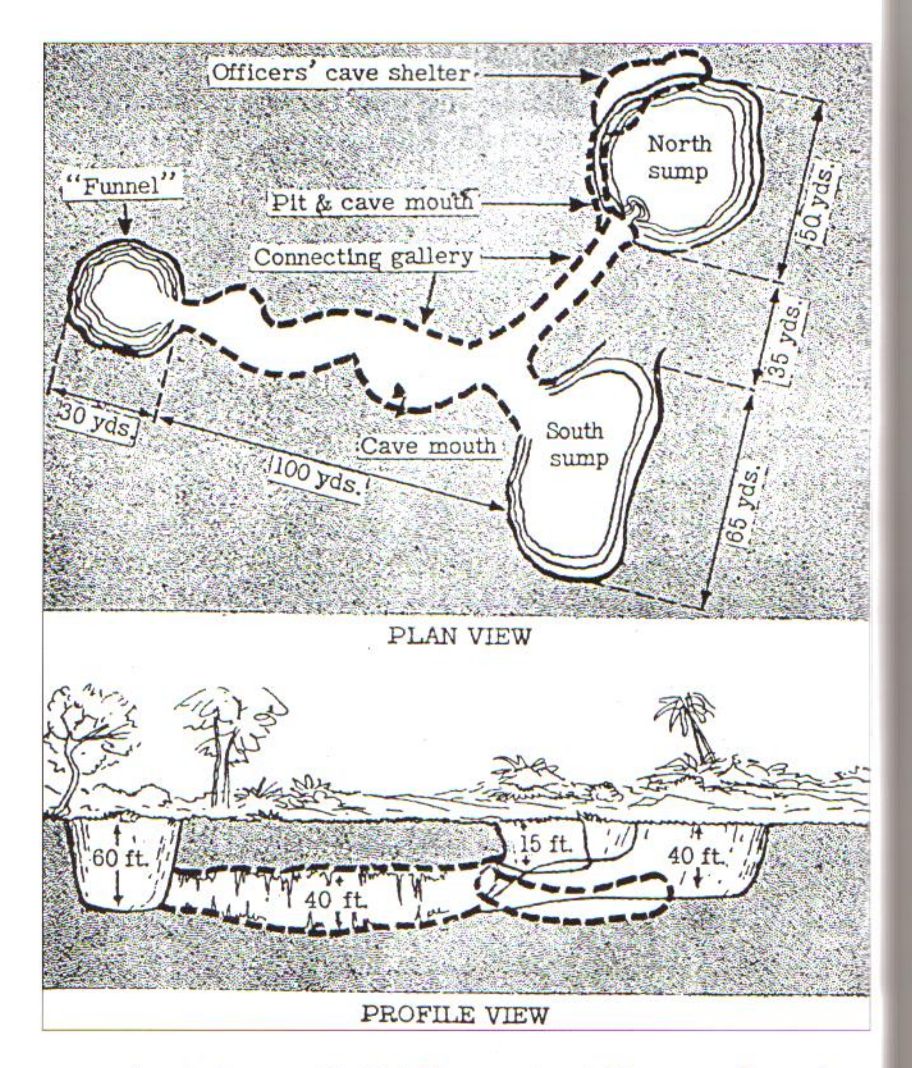
Even more effort went into HMG emplacements (see illustration on page 35) given that they provided significant fire. Open-topped HMG positions were dug as a U-shaped slit trench with the open end of the "U" facing to the enemy. The inside of the "U" served as the firing platform and was dug down 9–12in. The tripod might be braced with sandbags to improve its stability for long-range sustained fire. If a parapet was present the earth would be mostly piled to the sides and rear and only a few inches of earth was piled in front. A communication trench was usually present. Overhead cover was almost always provided for these important weapons. The sides and rear would be reinforced with logs, and a roof of at least a 2.5ft-thick log and sand would be built. The sides were revetted, and even the firing platform might be so. Ammunition niches were often present and a robust crew shelter might be situated to the rear.

These were considered minimal protection requirements. The degree of protection afforded these weapons was frequently more than the Allies would have provided similar weapons, and in many cases HMGs were provided with extremely robust and elaborate fortifications. Two or more heavy and light machine guns might share a multi-compartment position and be connected to supporting positions by trenches or tunnels. Large and heavily constructed concrete pillboxes were frequently encountered, as were elaborate cave positions with embrasure-pierced concrete walls covering the openings. From the outside many of these pillboxes appeared to contain a much larger weapon than just one or two machine guns. There were no set designs: they could be square,

RIGHT **Building a heavy machine gun pillbox**
An HMG crew, manning a Nambu 7.7mm Model 1 (1941), builds a position using the only tools and materials available to them, those they can carry and what nature provides. Shovels, picks, and sickles were normal infantry issue. The position is revetted with coconut logs dug-in vertically. Horizontal logs on the sides will be banked by sand. The roof will consist of two layers of logs, on top of which sheet metal may be placed: it will then be covered with sand and the whole camouflaged. In hard soil areas such a position might not be revetted. If built without overhead cover, soil would be piled to the sides and rear and the gun platform might be more horseshoe-shaped. A pit has been dug in front of the embrasure to prevent debris from blocking the field of fire.



Also encountered on Biak and Peleliu were sinkholes or sumps. This particular complex was dubbed the "West Caves" by the Americans. It was formed by portions of the cave's roof collapsing years before, which covered the sumps' bottoms with boulders. It housed some 900 well-armed holdouts and required over a week to reduce in spite of countless air strikes, blasting by artillery, demolition, and gasoline being pumped in and ignited. The Japanese emplaced mortars inside the connecting galleries' openings and fired them with their trajectory just clearing the lip of the sumps. Dozens of fighting positions surrounded the sumps.



rectangular, circular, or multi-sided. They were invariably protected by outlying rifle and LMG positions, which were often connected to the main and other positions.

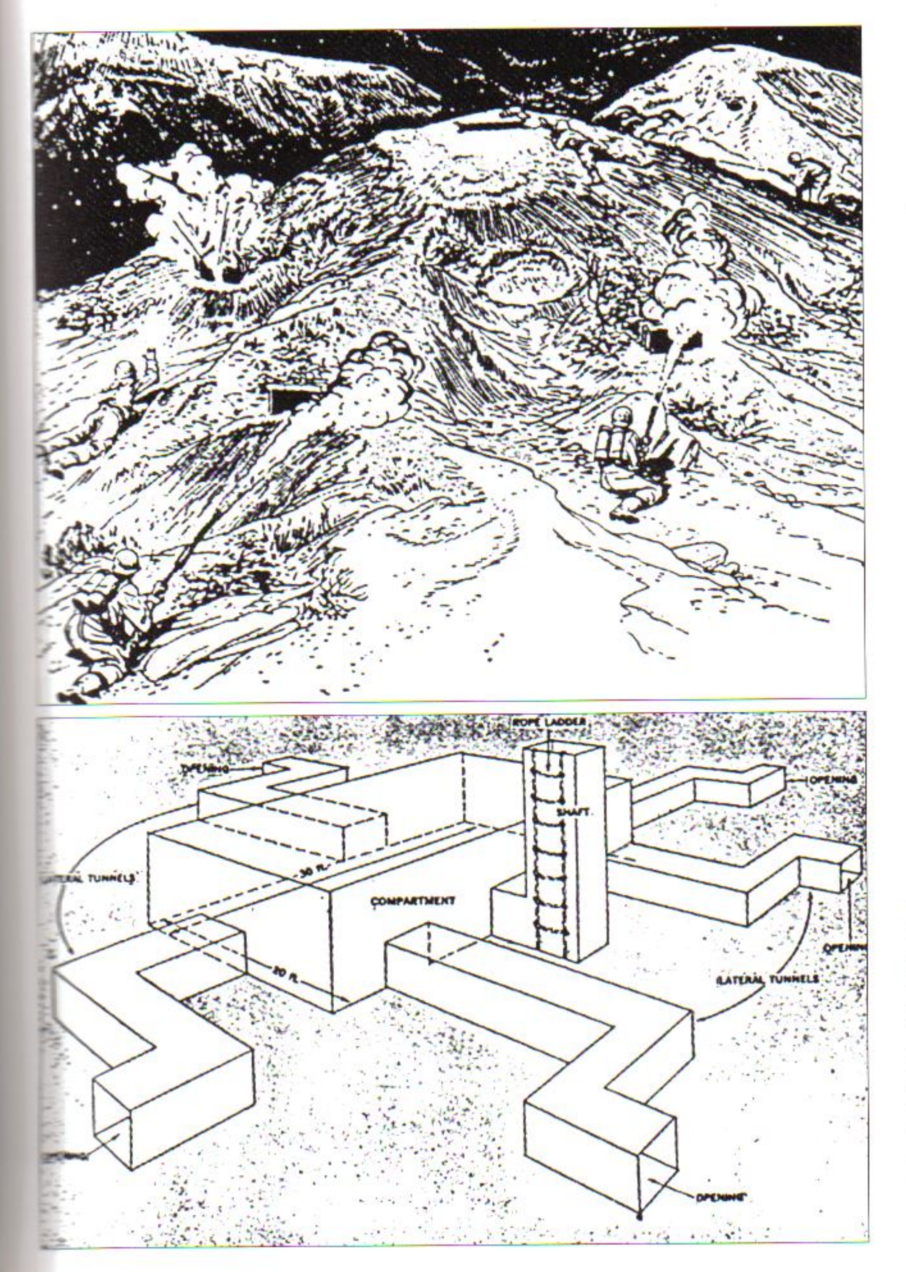
Grenade discharger positions too were based on one- or two-man foxholes. A firing shelf about 2ft deep might be dug into the forward side of the hole on which to place the high-angle firing weapon. In some instances, rather elaborate positions were constructed. These might be comparatively deep and provided with a firing platform and ammunition niches in the side. They were also fired from cave and tunnel openings, allowing the grenadier to withdraw into the interior to avoid return fire.

Positions for battalion 70mm and regimental 75mm infantry guns were generally dug in the shape of a cross about 3ft deep. This allowed the gun to achieve direct fire over the lip of the pit or to be elevated for indirect fire. The gun was positioned in the short ("upper") end of the cross and the long end was angled down into the ground to provide a ramp to ground level. A blast wall might be provided behind the ramp with enough space to allow the gun to be removed. The side arms of the cross were for the crew and ammunition. If overhead cover was provided the above-ground sides would be built up with logs and rocks, roof supports added, and covered with up to 5.5ft of logs, rocks and sand. The front end of the gun position might extend beyond the front firing embrasure to allow the gun to be pushed forward and fired at a high angle. The sides were revetted where possible.

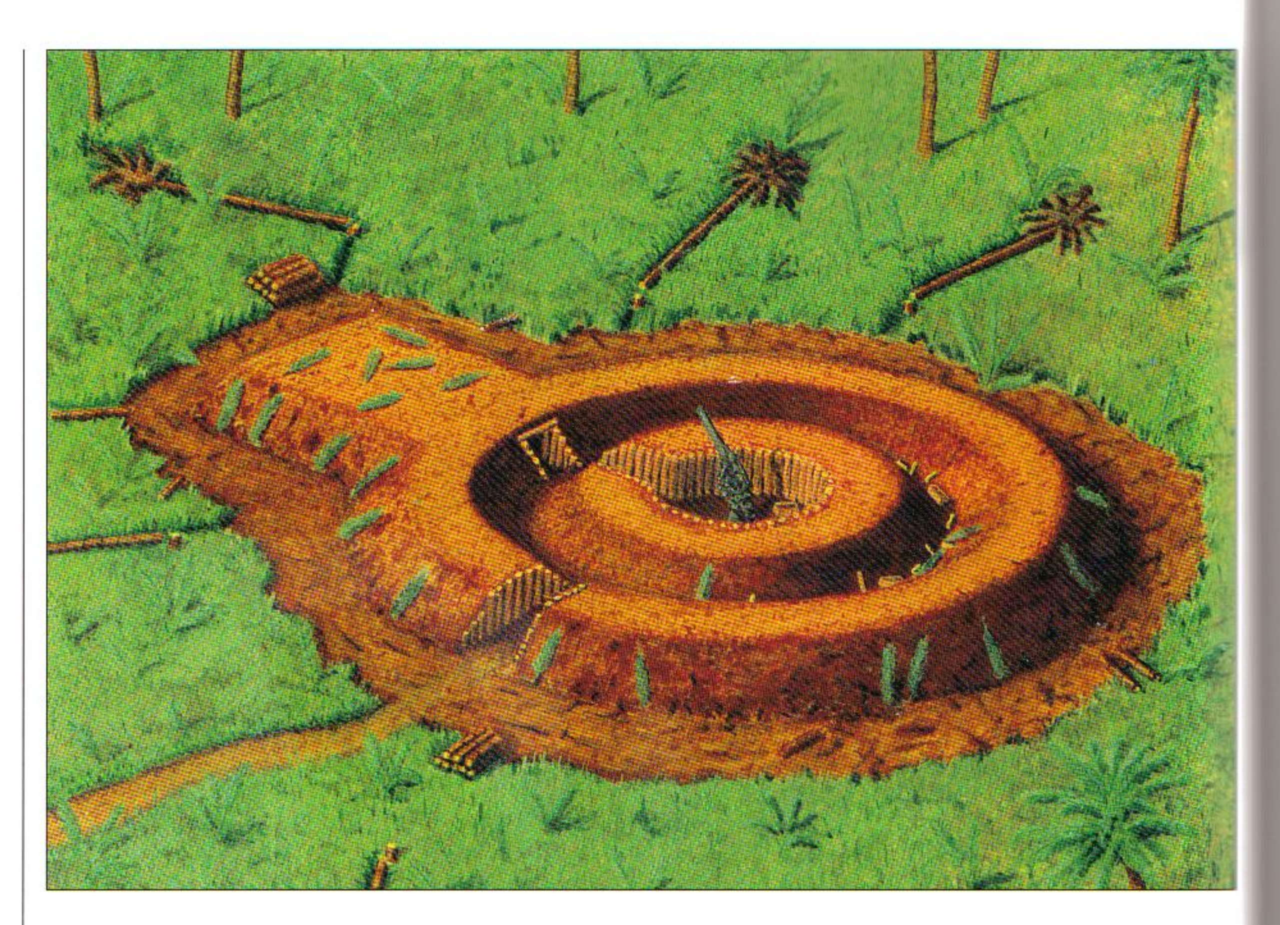
AT gun positions were constructed in a similar manner, but the lower arm of the cross needed to be wider (12–15ft) to allow for the opening of the gun's split trail (infantry guns did not have a split trail).

Field artillery emplacements were of similar design but larger, as required by the specific weapon. AT gun and field artillery pieces were emplaced in covered positions whenever possible. Log, rock, and sand positions might be constructed as described for infantry guns but because of the size of these weapons they were often emplaced in caves or tunnels. These might be provided with concrete or robust log and sandbag walls with firing ports, or the weapon may have been rolled out, a few rounds fired, and then moved deep back into the tunnel. Steel doors were sometimes provided. Elaborate concrete casemates of varied design were used as well.

Infantry mortar positions were usually emplaced in circular pits just large enough to accommodate the mortar and crew. They were also placed in gullies



On Luzon the Japanese built completely underground strongpoints on dozens of small hilltops. The hills were often in proximity to each other and provided covering fire. These strongpoints consisted of a deep central compartment as a shelter and living quarters. Branch tunnels led to firing ports. The well-concealed entrance was near the hill's crest. To approach it, attackers had to fight their way through the firing positions.



This Japanese "donut" anti-aircraft gun position is typical of the double-parapet construction used to protect such weapons from low-level bombing. This particular position protects an IJN 80mm Model 3 (1914) AA gun. Note the offset entrances and the magazine at the top. This type of position was difficult to conceal. Palm fronds (mostly removed here to show the emplacement clearly) were often laid on the parapets to make them more difficult to detect by low-flying, high-speed aircraft. Empty ammunition boxes and shell cases were often discarded between the parapets, making the position even more obvious. (Tom Idzikowski)

and ravines, and like artillery they were sometimes hidden in caves and brought out to fire. Occasionally they were set up inside the mouths of large caves, protected by a pit dug inside or a barrier. The crude Japanese artillery rockets employed late in the war required large clear areas because of the considerable back blast. This negated placing them in dug-in positions, cave and tunnel mouths being preferred firing areas.

IJN coast defense guns especially were provided with heavily constructed concrete casemates or emplaced in caves with concrete embrasures. In the early days of the war many IJN coast defense guns were emplaced in open-topped and even elevated positions to maximize their fields of fire. The Japanese found in the Gilberts that US air and naval gunfire made short work of such exposed guns. Open emplacements were still used in much of the Marshalls, but coconut log, coral rock, and sand-covered casemates began to be employed. Most such positions in the Carolines were protected by concrete, or the guns were positioned in caves. In the Marianas a mix of open, concrete casemate, cave, and tunnel emplacements were encountered. Cave and tunnel positions were the rule on Peleliu, Iwo Jima, and Okinawa (see illustration on page 10).

Anti-aircraft gun emplacements were generally circular and comparatively large to accommodate the sizeable mounting. The interior side of the parapet

may have been circular or hexagon-shaped. The need to provide them with a wide field of fire, often meaning they were placed in large open areas, made them virtually impossible to conceal. Camouflage nets were only marginally effective since the positions were large, in the open, and accompanied by searchlights, power generators, sound-locators, rangefinders, command posts, fire-direction centers, ammunition bunkers, bomb shelters, and light AA guns. Efforts were later made to reduce their signature by decreasing the slope of the parapet, planting it with vegetation, and concealing associated facilities. From 1943 some large-gun emplacements were surrounded by double revetments, called "donuts" by Allied aerial photo-interpreters (see illustration on page 38). The entrances were offset from one another. Naval gunfire and bombs dropped by low-level aircraft often struck at low angles. The shell or bomb would hit the outer revetment and breach it, but the inner parapet protected the gun and crew. Ammunition bunkers and troop shelters were often attached to AA gun emplacements. Concrete gun emplacements sometimes had these built beneath them. Emplacements too were sometimes built on raised mounds to provide the weapon with a wider field of fire, especially if there were tree lines within a few hundred yards. This of course made the position even more conspicuous. Numerous ready ammunition niches were built into the inside of the parapet.

Since their direction of fire was upward the emplacements were often fairly deep. However, they were often positioned to allow them to engage surface targets, be they enemy tanks, troops, or landing craft. Larger AA guns often doubled as coast defense guns to engage ships close to shore. Besides HE, all 40mm and smaller-caliber AA guns were provided with AP ammunition for use against armored vehicles. The 75mm and larger guns had only HE rounds, but these were effective against tanks at moderate ranges. Individual small-caliber AA guns were frequently emplaced in scattered positions among beach defenses as anti-boat guns and to engage troops and vehicles gaining the beach. While some were positioned in open-topped emplacements allowing them to engage aircraft, most in this role were placed in casemates.

Depending on the type of gun, AA weapons were usually emplaced in close proximity to each other with three- to six-gun batteries positioned in a ragged line or a crescent shape. The battery command post and fire-direction center would be close by. Searchlights and sound-locators would be off to the sides. Bomb shelters and ammunition bunkers would be placed among the gun

Japanese anti-aircraft gun emplacement dimensions

Given below are the inside diameters of open-topped gun emplacements. The outside diameter depended on the thickness of the parapet, which varied greatly. Many emplacements were capable of coastal defense or engaging ground targets.

Weapon	Diameter
7.7mm machine gun	6–8ft
13.2mm single machine gun	9–12ft
13.2mm twin machine gun	7–10ft
20mm machine cannon	8–15ft
25mm single machine cannon	8–10ft
25mm twin and triple machine cannon	12–16ft
40mm twin AA gun	10–16ft
75mm AA gun	18–22ft
80mm AA gun	14–20ft
105mm AA gun	20–25ft



Southern Okinawa, June 1945. Multiple cave openings and firing ports dug into a defended pinnacle were exposed by blasting away the vegetation with direct artillery fire. Most of the openings were protected by piled rock walls, some of which partly collapsed.

The Japanese made extensive use of decoys and dummies to mislead Allied aerial photo-interpreters. Even at treetop-level this dummy AA gun with a crew of straw men on Ie Shima off Okinawa would fool a fast-moving aircraft pilot.



positions with troop quarters a hundred yards or so distant. Anywhere from one to three smaller-caliber (13.2, 20, 25mm) AA guns would be emplaced to the flanks of the battery for close-in air defense. The batteries themselves were within a few hundred yards of the area to be defended; an airfield, harbor, or base.

Maximum use was made of caves wherever they existed. The most widespread use was on Wakde, Biak, Saipan, Guam, Peleliu, Angaur, Luzon, Iwo Jima, and Okinawa. The nature of caves varied from island to island depending on geological characteristics. Most were created through the erosion of limestone by groundwater or underground streams. Others were created by lava flows or earthquake faults. No two caves were alike and they could range in size from a small shelter holding a couple of riflemen hidden behind a pile of rocks to a massive, complex cavern sheltering hundreds of men with well-developed support facilities. Power supply and water systems were provided in some. They could be used for virtually any military purpose, although this depended on their size, layout, and most importantly, location. Gun positions, troop shelters, command posts, hospitals, munitions and supply storage were some of the uses caves were put to. Larger caves consisted of interlinked compartments and often had multiple levels. Many entrances were provided with concrete or rock walls with firing ports. Large cave entrances could not be effectively blocked though, but blast barriers might be constructed, either at the entrance or well inside. Caves were often improved by enlarging chambers, leveling floors, expanding connecting galleries, and connecting defensive positions and other caves with manmade vertical tunnels or horizontal shafts. Steps cut into rock, wooden stairs, and wood or rope ladders were used to move between levels. Tunnels were also dug to provide additional firing ports. Air shafts and escape tunnels were often provided. Water collection sumps were dug in wet caves and tents, and even small buildings were erected to protect against dripping water.

Massive work went into the improvement of cave systems. Often the Japanese found it difficult to dispose of the enormous quantity of excavated spoil well away from caves and to cut and transport sufficient shoring timber. On Iwo Jima the Japanese experienced difficulties as the volcanic rock was so hot it was impossible to work in some areas. They were prevented from working in other areas because of sulfur fumes and lack of shoring timber. So many caves and manmade tunnels existed on Iwo Jima and Okinawa that the entire 21,000- and 87,000-man garrisons respectively were completely sheltered.

Caves were difficult to overcome, being impervious to bombs and naval gunfire. Even a direct hit in the mouth had little effect on large caves. Flamethrowers and direct gunfire allowed attackers to approach and pump in gasoline to be ignited by white phosphorus or demolition charges – but even this was ineffective in large, complex systems. Blasting shut the entrances with

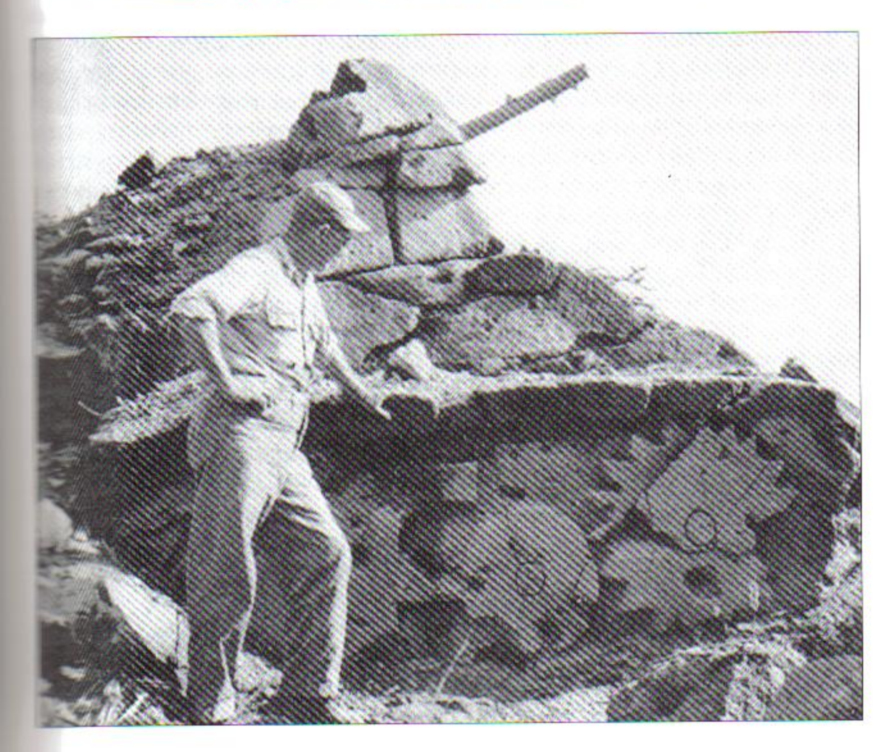
large amounts of explosives or bulldozing them over were the only ways to effectively overcome them, but even then there were still the other firing ports, escape exits, and connecting tunnels to other caves.

Principles of camouflage

The Japanese were renowned for the effectiveness of their camouflage. Even veteran assault troops experienced difficulty in detecting Japanese positions. Natural camouflage was used as much as possible. Besides blending and contouring fortifications into the surrounding terrain, positions were also built among trees. Ground cover materials and sods were carefully removed before excavation began and once the position was completed it was replaced. Small plants and young palms were often planted on the tops and sides of earth-covered positions and watered. Care was taken to ensure transplanted vegetation matched that in the immediate area. The Japanese excelled at blending camouflage with its natural surroundings. Machine gun firing lanes were carefully cleared through dense vegetation. Only selected low vegetation was removed along with the lower branches of bushes: trees, saplings, and larger bushes remained. Troops advancing through dense vegetation would be unaware that they had entered a "cleared" field of fire as they were focused ahead and unaware their boots were visible to Japanese machine gunners at ground level.

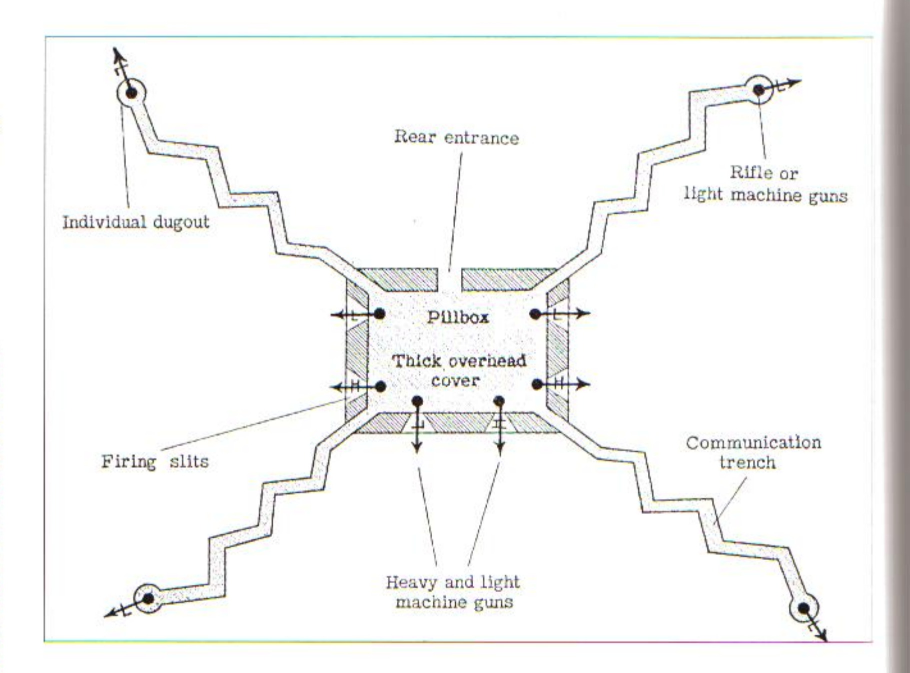
Palm tree fronds were used extensively to camouflage fortifications by simply laying them in haphazard, overlapping layers on structures, on parapets, over trenches supported by bamboo or limbs, and over firing ports. After bombing and shelling the ground was covered with fallen palm fronds and other debris making it difficult to detect fortifications from the air or even at close ground ranges. A gunner inside a machine gun nest could see through the thin gaps between the fronds' long individual leaves, but from a distance it would look like more battered palm fronds scattered on the ground.

Camouflage nets with green, brown, and tan garnishing (burlap stripes woven through the mesh) were issued to conceal artillery positions, parked aircraft, vehicles, and other facilities. Nets were sometimes laid out on the ground to cover trenches and their parapets. When mixed in with natural vegetation it was



On Iwo Jima a hilltop soft volcanic rock outcropping was carved to resemble a light tank and a tree-branch gun barrel fitted. Numerous Marine tankers reported knocking out this "tank."

An idealistic example of a central Japanese pillbox with communication trenches or tunnels radiating from it. In reality the layout would be much less geometric, but very irregular, taking advantage of terrain and available concealment. The central pillbox might have fewer machine guns.



Camouflage

The following description, written by a solider in the October 1944 *Atlantic Monthly*, describes the effectiveness of Japanese camouflage as well as the layout of defenses on Parry Island, Eniwetok Atoll.

"[Japanese] emplacements were so well concealed as to be difficult to spot even a few feet away. Most of them were underground hideouts large enough for a few men, with no embrasures or firing ports. A typical strong point was arranged like a spider's web. In the center would be an underground shelter for five to ten men, lined and roofed with coconut logs, over which were strips of corrugated iron and then a thin layer of sand. The radiating tunnels were lined with headless gasoline drums placed end to end, big enough for a Japanese to crawl through, and far better concealed than a mole's tunnel in a lawn. Around the periphery of the web were round foxholes 10 to 15ft apart, most of them roofed with corrugated iron and interconnected by narrow trenches or tunnels. If his center shelter was discovered the Japanese would crawl to the periphery, pop out and take a shot at one from the rear, and pop back in again. The Marines had already encountered similar defenses on Eniwetok Island, but Perry was honeycombed with them, well camouflaged and very hard to find."

The island's beaches were also lined with fighting trenches and machine gun nests connected to underground shelters in the rear by narrow communications trenches and tunnels.

difficult to detect the trenches from the air. Recently turned earth or sand around field fortifications was highly conspicuous in black-and-white aerial photographs, appearing bright white against the grays of undisturbed soil and vegetation. Palm fronds were extremely valuable for covering turned soil. Paper painted to match the rocks was sometimes pasted over cave firing ports to conceal them.

Cave openings were very difficult to conceal. Those with concrete walls over the openings were seldom made to blend into the side of a ravine or hill. They were either concealed with vegetation or rocks were piled in front in a natural manner. Some were just too large to conceal or wall over.

Some concrete pillboxes and casemates were camouflage-pattern painted as were large support structures such as hangars, warehouses, barracks, command posts, radio stations, fuel and ammunition bunkers, and such like. Surprisingly, while the Japanese were adept at natural camouflage, their artistic flare for camouflage painting buildings was less than effective. The patterns and colors were seldom appropriate for the vegetation and terrain. They were often limited by the few available colors, but the disruptive patterns they selected were unsophisticated and sometimes attracted more attention to the building than if it had been painted a solid subdued color.

The Allies inadvertently aided Japanese camouflage efforts. Pre-landing bombardments cratered the ground, demolished above-ground support structures and widely scattered rubble and wreckage, and blasted vegetation. This provided the defenders with additional concealment and the battered terrain made it that much more difficult for assault troops to detect positions.

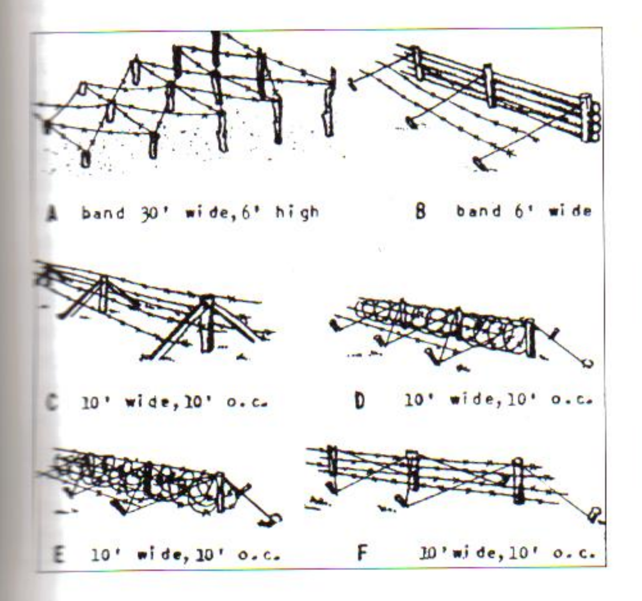
The Japanese also used dummy and decoy positions, facilities, and equipment. This served as a deception for the location and extent of defenses and drew enemy attention from actual positions. The key was to camouflage decoys to a believable degree, but leave them sufficiently visible to be detected. Dummy coast defense and AA gun positions were commonly constructed in lightly defended areas in the hope of causing the enemy to attack elsewhere, perhaps in a well-defended area with extremely effective camouflage. Such positions were lightly and simply constructed to appear real from a distance and painted logs were set-up as "guns." Even uniformed straw "soldiers" manned the guns and paths and vehicle tracks were made throughout the "defended area." Dummy trench systems, less than a foot deep, were dug and partly camouflaged. Dummy aircraft were often built and placed in revetments along real or decoy runways.

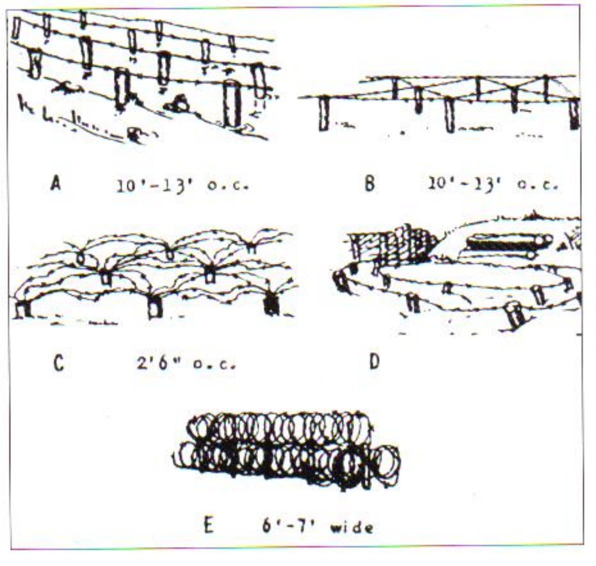
Obstacles

Like all armies the Japanese practiced the universal doctrine of employing obstacles to deny or delay the movement of troops and vehicles, and using them to channel the enemy into the field of fire of weapons or minefields. They understood that unless obstacles were under observation and covered by fire they were ineffective. As with fortifications, Japanese obstacles were constructed largely of local materials and local initiative was used in their design. Anti-personnel obstacles were mainly made of barbed wire, stakes, and posts. Anti-vehicle and anti-boat obstacles were more robust, comprising concrete and girder pilings, heavy timber and post pilings, logs, boulders, wrecked vehicles, wide and deep AT ditches, wall-like barricades, and such like. Natural obstacles were terrain features that denied or restricted movement and were especially effective against vehicles, as well as slowing foot troops. Lakes, ponds, rivers, large streams, swamps (with trees), marshes (without trees), dense vegetation, vehicle-denying broken terrain, gullies, and ravines were suitable natural obstacles. Often manmade obstacles were integrated into natural obstacles to reinforce them. Underwater or anti-boat obstacles were those emplaced on approaches to landing beaches and intended to halt or damage landing craft and amphibious vehicles. Beach obstacles hampered the movement of troops and vehicles.

Japanese manuals specified standard barbed wire barriers, but these were little used on Pacific islands due to shipping space limitations and the diversion of Japan's modest steel production to other pressing needs. Japanese barbed wire barriers were similar to US and British designs. In fact, post-World War I British manuals were often copied.

Standard single- and double-apron barriers were used. These comprised a common four- to six-strand barbed wire fence on 2.5- to 4ft-high wooden posts emplaced at 6–10ft intervals. The apron portion consisted of diagonal anchor wires running from the top of the posts and staked to the ground 6–8ft out. Several horizontal wires were attached to the diagonal wires. Double-apron fences had the slanted aprons on both sides while the single-apron had it only on the enemy's side. High-wire fences consisted of two or more rows of posts the same height and at the same interval as apron fences. Each row of posts had several horizontal strands attached. The rows were 6–10ft apart with additional strands running diagonally between the rows creating a spider web appearance from above. Low-wire fences were seldom over 1.5ft high and consisted of horizontal strands or loops of wire intended to trip and slow assault troops.





Examples of Japanese barbed wire obstacles. The left-hand frame obstacles were usually found on the beach or blocking avenues inland. A–D in the right-hand frame are examples of tanglefoot tripwire found around fighting positions. E is triple concertina wire.

Japanese units were provided with little barbed wire. One substitute was sharpened bamboo stake barriers. These had been concealed by 5ft-high kunai grass, which these Marines tromped down to allow the barrier's removal.



Emplaced on low ground and within vegetation, they were almost impossible to detect from the air and even on the ground until among them. Coiled concertina wire obstacles were also used, but had to be made in the field: these were not issued in spring-steel wire form. As the Japanese issued little barbed wire it was often augmented with smooth wire and even steel strapping bands.

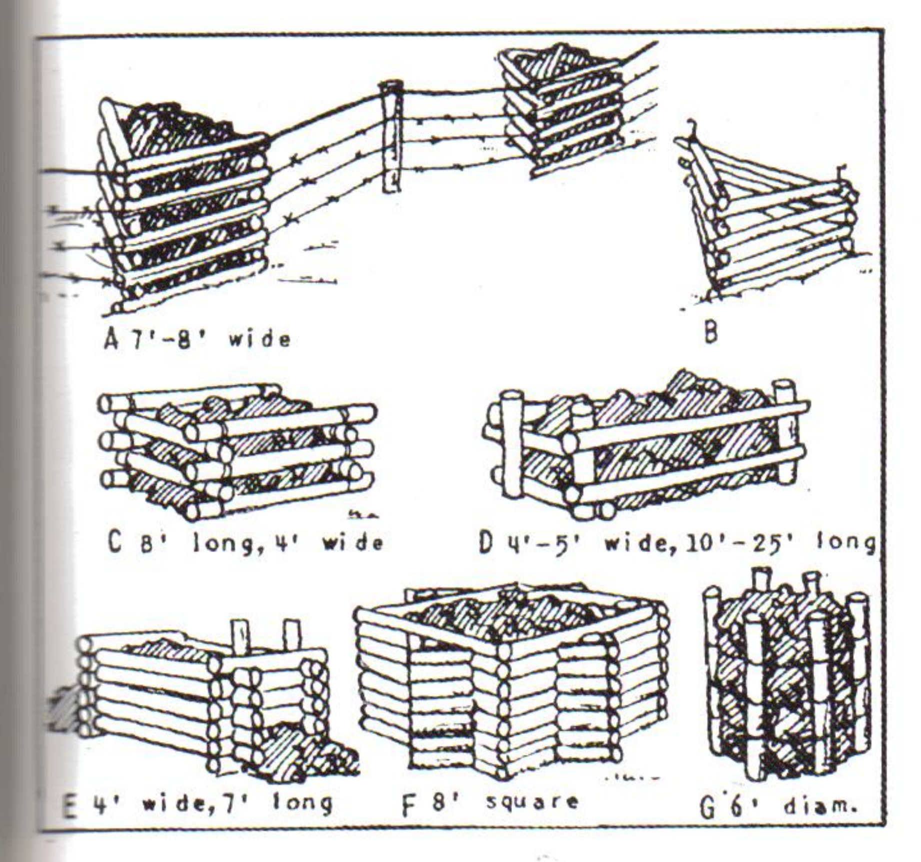
The Japanese had no detailed doctrine for underwater and beach obstacles when they set upon their conquest of the Pacific. They made no attempt to emplace such obstacles on the large islands of the Solomons and Bismarcks as there were simply too many places for the Americans to land. None were encountered until the November 1943 Tarawa and Butaritari (Makin) assaults. Even from that point on, few significant underwater and beach obstacle systems were encountered, and these tended to be on islands defended by IJN Land Forces. The IJA relied more on beach area minefields and obstacles ashore.

The construction of underwater anti-boat obstacles depended upon near shore water and bottom conditions. If the water was too deep, a heavy pounding surf present, the bottom gradient too steep, or the bottom too soft to support obstacles, they could not be employed. Islands on which underwater obstacles were placed were usually coral atolls with mostly level fringing coral reefs. The most common were four-sided concrete pyramids (often with steel angle-iron bars projecting from truncated tops); square, rectangular or triangular log cribs filled with rocks; rock cairns (piled rocks); fence-like anti-boat barriers (usually three horizontal logs secured to pilings); log hedgehogs (tripods); steel pipes; and log pilings. They were usually emplaced in single rows, often with barbed wire strung between them to ensnare wading troops, to be just covered at high tide. Rock and coral outcrops and large potholes in coral reefs were incorporated into the obstacles. Unless breached, such obstacles could halt landing craft, amtracs, and wading tanks. They were easily destroyed by demolition charges emplaced by US Navy Underwater Demolition Teams (UDTs) routinely employed from January 1944 (Kwajalein Atoll). Most beaches were narrow, especially at high tide when landings were made, and few beach obstacles were employed other than mines.

The Japanese initially paid little attention to AT obstacles and usually lacked sufficient concrete and steel girders for their construction. Log pilings were sometimes driven in single, double and triple rows. Hardwood logs 10–12in. in diameter and 5–10ft in length were driven into the ground with about two-thirds of their length above it. If coconut logs were used, three logs were bound together with wire or cable to provide sufficient strength. Concrete posts or steel pipes were used in the same manner.

The most widely used Japanese AT obstacle was the ditch. AT ditches sometimes backed beach defenses, but more commonly they cut across or partly across the narrow islands to restrict the advance of American tanks. In cross-section the ditches were either triangular or trapezoid in shape. The former were dug in sloping ground and the latter on level ground. They were 10–20ft wide across the top and 5–10ft deep. Spoil was usually piled on the defenders' side, but might be removed to make the obstacle less conspicuous to aerial observation.

The Japanese use of minefields was mostly ineffective until after Saipan. Extensive minefields were laid in the Philippines, Iwo Jima, and Okinawa. Previously they had been poorly sited and ineffectively camouflaged. The improved doctrine provided prescribed patterns and techniques, although a great deal of variation was found in minefield patterns. They were emplaced on and behind beaches to hinder vehicle movement. Reinforced AT obstacles, laid between AT obstacles, blocked beach exit routes and were laid on avenues of approach that terrain conditions made difficult to construct other obstacles. Besides standard AT mines (which troops on foot normally cannot detonate), the Japanese made extensive use of buried aerial bombs and depth charges, sometimes electrically command-detonated. Few anti-personnel mines were employed and were usually mixed in with AT mines. Few booby traps were used by the Japanese.



Examples of log cribs used as underwater obstacles to damage landing craft and amtracs. These were usually filled with coral rock and emplaced just below high water level. UDT frogmen had little trouble locating and destroying them with demolition charges.

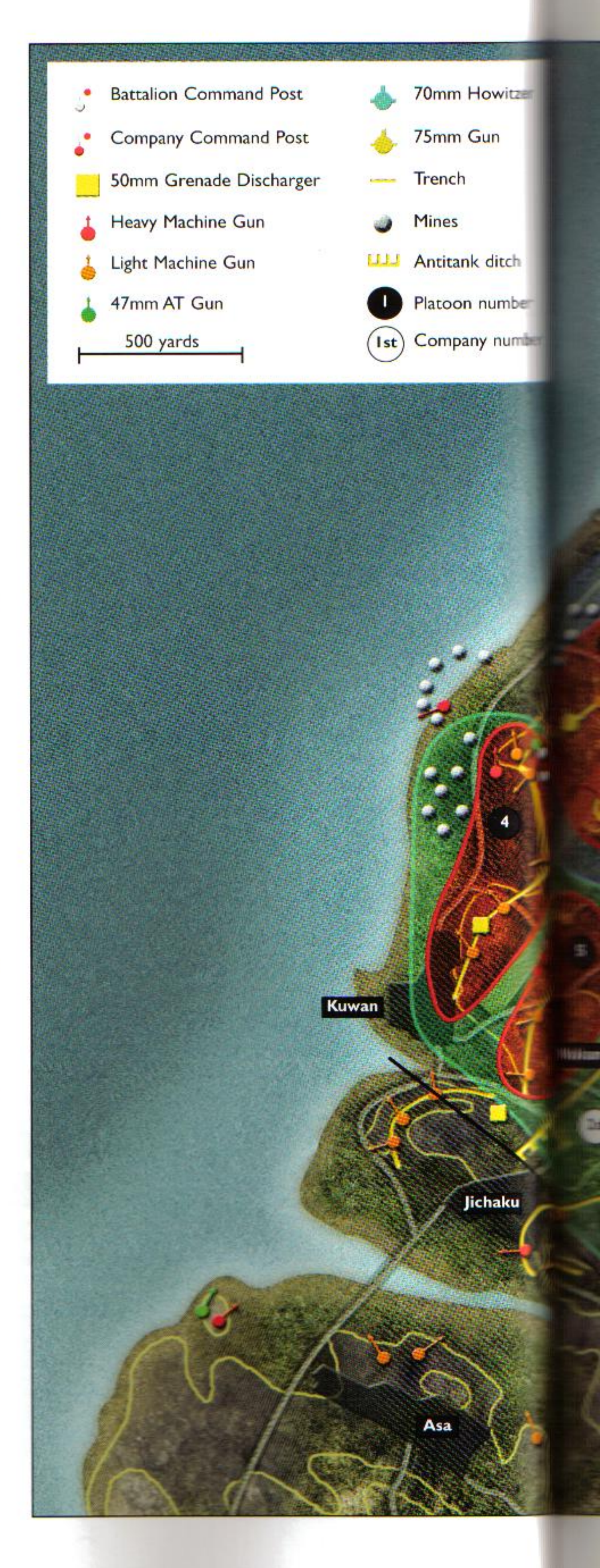
In-depth defense of a beach

This map depicts 14th IIB, 63d Brigade, 62d Division dispositions for a defense against an amphibious landing on the lower west coast of Okinawa north of Naha, March 1945. While US forces did not land in this sector, this map, adapted from a Japanese sketch, provides an excellent example of in-depth coastal defenses. The battalion's mission was to deny the enemy the use of Machinato Airfield, block roads heading inland, and prevent the use of Route 1 for lateral movement along the coast.

The 1,085-man battalion possessed five rather than the usual four rifle companies plus machine gun and infantry gun (two 70mm, two 75mm) companies. It was reinforced by four additional 75mm regimental guns, four 47mm AT guns, and two 81mm mortars. Over 30 HMGs are noted, indicating that it was heavily reinforced by independent machine gun battalion elements. Not all 50mm grenade dischargers are indicated. Note that the scattered mine symbols represent mined areas and not individual mines.

Some 40 light and heavy machine guns directly cover the beaches. A number of positions allow enfilading fire down the beaches to hit landing troops from the flanks. Numerous intermediate positions are behind those covering the beaches, while a second line of defense is located on the ridges to the east of Miyagusuku and Yafusu with that line backed by still other positions along higher ridges. The center of the second line is protected by AT ditches while the 9th Platoon's position on the south side of Yafusu provides a strongpoint to block movement between the two villages, which the Japanese knew would be blasted to rubble and pose an obstacle to American armor.

Additional positions behind the ridges provide depth to the defense. With a total of 15 rifle platoons the battalion was able to establish considerable depth to its 4,500-yard wide, 3,000-yard deep sector. Even though the battalion had five rifle companies, only two were deployed forward rather than using other companies on a broad, difficult-to-control front. The other companies were deployed to achieve maximum depth, a primary aim of the Japanese. An analysis of the deployment of each company's platoons is of interest. The 2d Company on the left flank deployed its platoons one behind the other with the obvious secondary mission of protecting that flank bordering the 22d IIB, 64th Brigade. The 3d Company deployed two platoons forward with the third (9th) to the rear in a strongpoint, the standard arrangement. The 5th Company's 13th Platoon defended a ridge (later dubbed Potter's Ridge by the Americans) that provided flanking fire on beaches to either side. The 14th Platoon covered a wide sector that was probably assessed as an unlikely landing site, while the 15th Platoon supported it from the rear. The 1st Company had one platoon forward manning a ridge comprising the second line with two platoons in the rear on rough ground, making it difficult to root them out and adding additional depth. The 4th Company likewise deployed one platoon forward on the second line ridge backed by the other platoons on a higher ridge in the vicinity of Dakeshi.





13
Machinato
14
8
5th
15
13th IIB
14th IIB
Gusukuma
airfield
7
Iso
3d
3
Yafusu
1st
9
1
Miyagusuku
2
Awacha
(Nakama)
6
11
4th
14th IIB
22d IIB
10
12
Uchima
Dakeshi

Principles of island defense

The following paraphrases excerpts from a translated Japanese treatise on the defense of a coral atoll published in the US Army's *Tactical and Technical Trends* in 1944. Many of these principles applied to large islands as well.

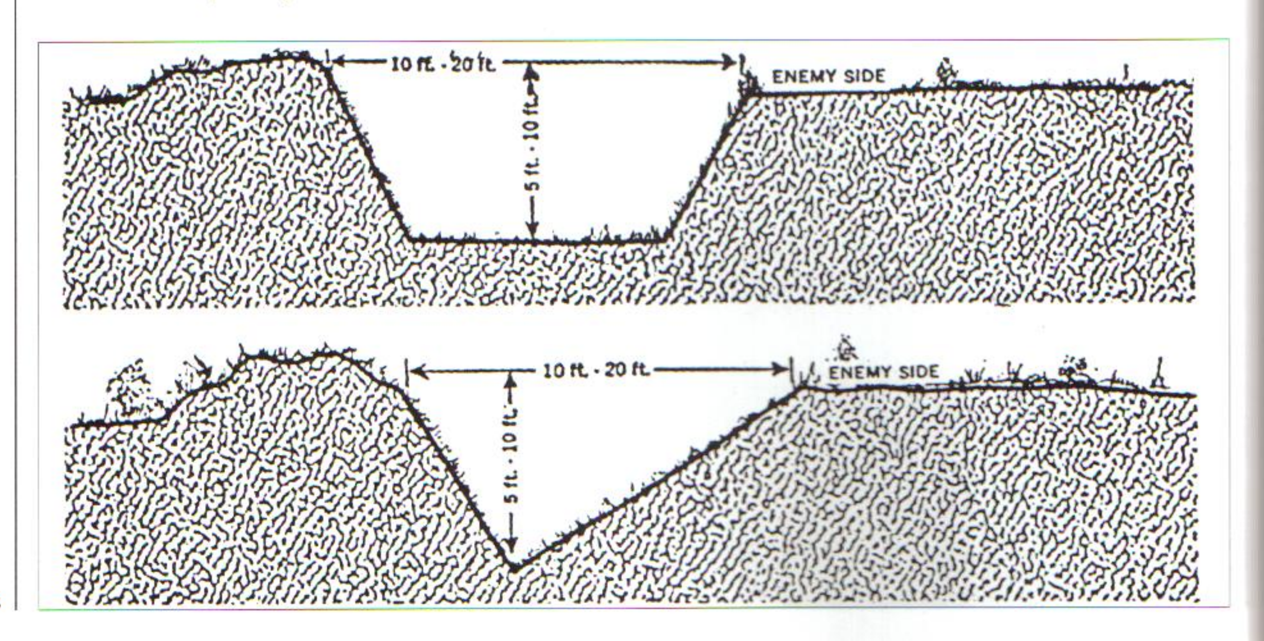
The organization and establishment of positions differs on the size of the island, the garrison's forces, weapons, *matériel*, and the situation of beaches where the enemy may land. However, in the case where the strength of the garrison is comparatively small in relation to the size of the island, if an attempt is made to defend the island by stationing troops all around the shore line, the defense will be weak everywhere. It is best to organize defense areas at important places, to hold critical installations, with a large force held in reserve. The intervals between defense areas should be covered by fire and obstacles constructed in these intervals. Small supporting [strong]points between the main defense areas may be occupied. The plan of defense should be to destroy the enemy at the water's edge, but should he land, he will be annihilated by counter-attacks.

The garrison of the defense areas differs, depending on the mission and size of the area. On a coral island, ordinarily one or two companies are necessary to garrison each defense area. The frontage assigned varies according to the type and number of weapons located in the area as well as the number of platoons in the frontline.

The frontage assigned to the various units is determined by using density of fire as the standard. Density of fire required for stopping an attack dead is five rounds on one meter of front every minute. Minimum limit of density of fire – three rounds per minute (rpm). These include rifle (10 rpm), LMGs, and HMGs (150 rpm). The HMG is used for flank defense. On the front the rifles and LMGs are used according to a fixed plan, or to fire at will on targets.

An LMG section ["rifle squad"] physically occupies about 30–40m, but covers 50–90m of front with fire. The interval between men is 6 paces (4–5m). The interval between the foxholes is 3–4m.

Antitank ditches were commonly trapezoid or triangular in cross-section. Erosion of sand often gave them a rounded bottom though. Spoil piled on the enemy side would make it more difficult to cross. The Japanese would habitually range AT ditches with artillery, mortars, and machine guns to limit their use as cover by infantrymen.





Japanese signs warning of mines, booby traps, and dud munitions.

A platoon front covers 200–300m with a 65m interval between sections. The company front covers 400m with two platoons in the frontline and 600m with three on line. The battalion front covers 800m with two companies on line, one in the second line, and one in reserve or in the second or a third line. With three companies in the frontline it would cover 1,800m. Gaps between platoons and companies are covered by HMGs wherever possible. Depending on terrain and avenues of approach, approximately one-third of a unit's machine guns might be assigned wide sectors of fire (30 degrees) to cover the unit's entire front. Other machine guns are assigned narrower sectors covering designated avenues of approach.

In the above, a standard was sought, but in actual practice circumstances will vary so much that it is not possible to follow this standard rigidly. If there is much dead space, the capabilities of the weapons cannot be fully utilized, and the frontage is very reduced. In the case of firing over water as in coastal defense, the frontage can be increased up to the limit of easy control.

Reserves should be stationed at a point from which it is easy to move them up to reinforce the frontline [beach defenses], or to counter-attack, as required by the situation. On coral islands, there is little space in which to maneuver for a counter-attack, so in many cases counter-attacks must be made frontally.

Japanese coast defense gun emplacement dimensions
Given below are the inside diameters of open-topped gun emplacements. The outside diameter depended on the thickness of the parapet, which varied greatly. Some positions were built in a rectangular, square, or semi-circular shape. Covered casemates varied greatly in size and shape. Twin dual-purpose gun positions were always open-topped to allow them to engage aerial targets.

100mm twin dual-purpose gun	30–35ft
120mm coast defense gun	34–37ft
127mm twin dual-purpose gun	22–26ft
150mm coast defense gun	26–30ft
200mm coast defense gun	37–39ft

Therefore, it is advantageous to have tanks available. Furthermore, as the enemy has planned to use amphibious tanks in landing, it is necessary to have *matériel* ready for close-quarter AT defense.

The interval between defense areas will vary with the type of weapons used to cover these intervals. If machine guns are to cover the space with crossfire from both sides, the interval is about 600m; if machine guns from each side cover one-half of the ground, it may be about 1,000m. When covered by artillery fire, the interval may be 2,000–4,000m. In case an interval between defense areas is great, it is necessary to close the gap by organizing small support areas between them.

The enemy's landing must be prevented by blocking the intervals between defense areas with obstacles as well as by covering with fire. Wire entanglements are commonly used as obstacles, and in areas where it would be easiest for the enemy to land, wire entanglements and land mines are used together.

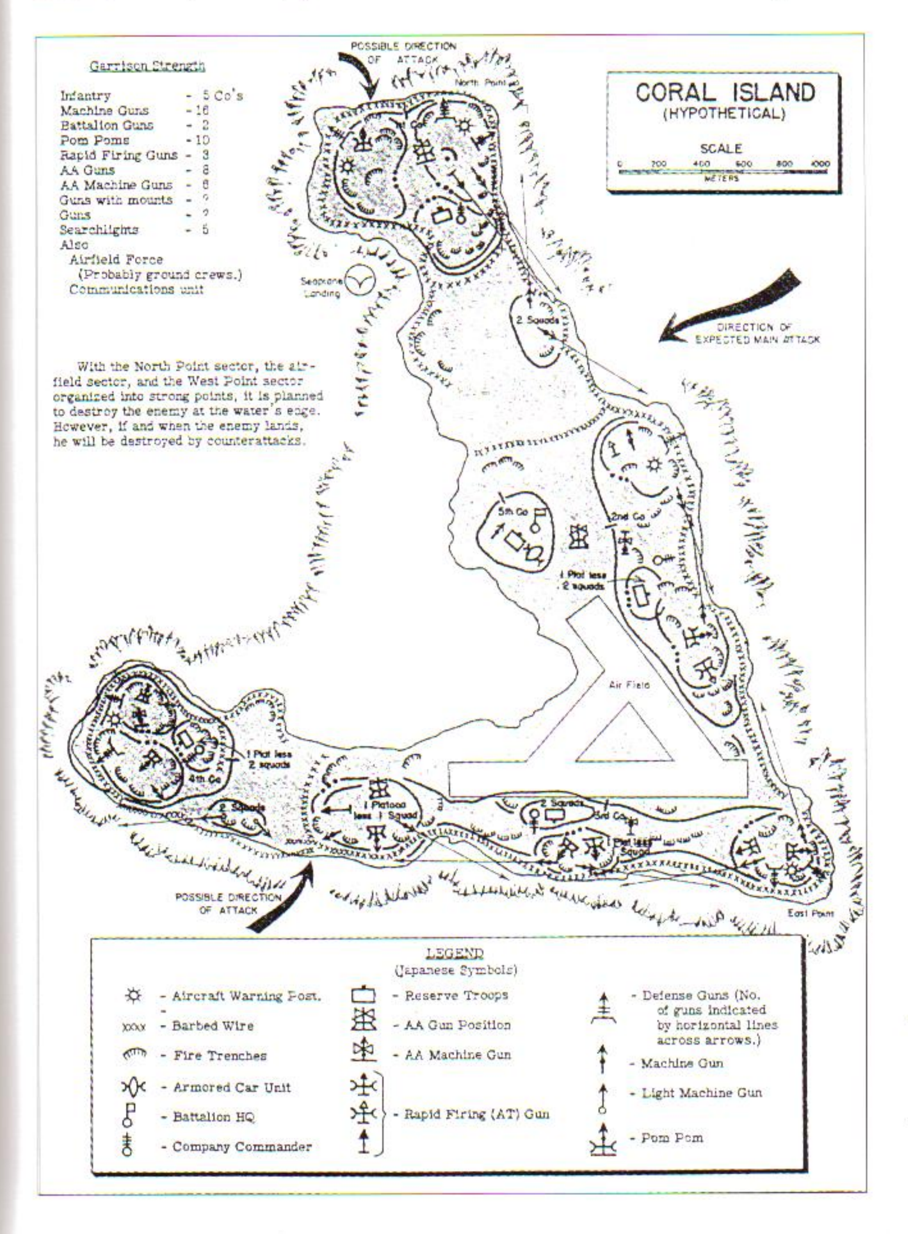
Heavy- and medium-caliber coast defense guns are chiefly used in shelling the ships covering the enemy's landing and the transports, and the small-caliber guns are to destroy landing craft offshore or, when he lands, to cooperate in the fight at the water's edge. They also have the duty of engaging enemy tanks. Usually the heavy- and medium-caliber guns are placed at the most important points, and the small-caliber guns are distributed among the defense areas. All of these guns must be fully protected by the infantry in the defense areas. The small-caliber guns, however, when necessary, may occupy positions outside defense areas, or a part of them may be kept in reserve.

Since the enemy plans to approach at high speed at night with highly maneuverable ships to make a surprise [dawn] landing, it is necessary to keep an especially strict guard to avoid being surprised. To this end it is necessary that the observation net be organized so that important areas can be observed from several directions and so that even the comparatively unimportant areas will not be unwatched (includes adjacent islets).

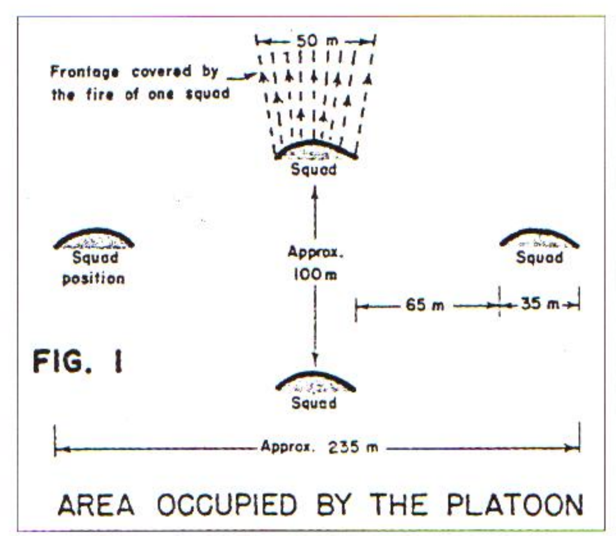
Coral islands are generally level and it is difficult to utilize the terrain for the protection and concealment of positions and installations. It is most necessary to use camouflage to conceal the positions and the disposition of weapons, and to use dispersal to limit damage. It is expected that strong, permanent installations will be built to stand up under shelling and bombing, but these cannot be built to meet an emergency. Ones which are strong enough to protect from bullets and shell fragments may be considered advantageous. Heavy weapons, used for flank defense, should have light covers; the other weapons should be uncovered, but completely camouflaged. At the same time reserve positions should be established and emplacements for the weapons should be constructed near the position to prevent damage during shelling and bombing.

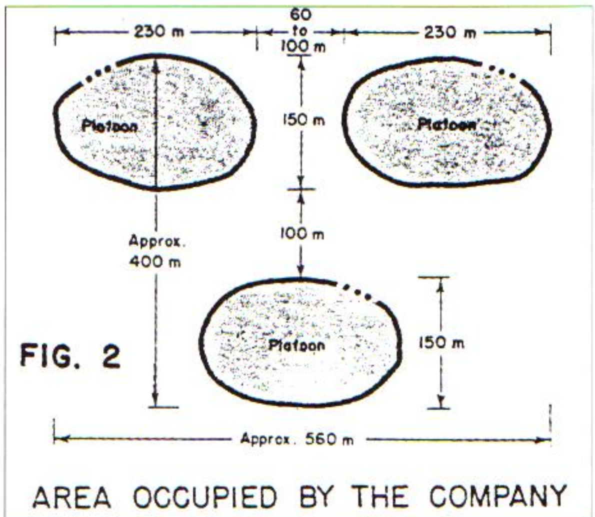
Defensive action

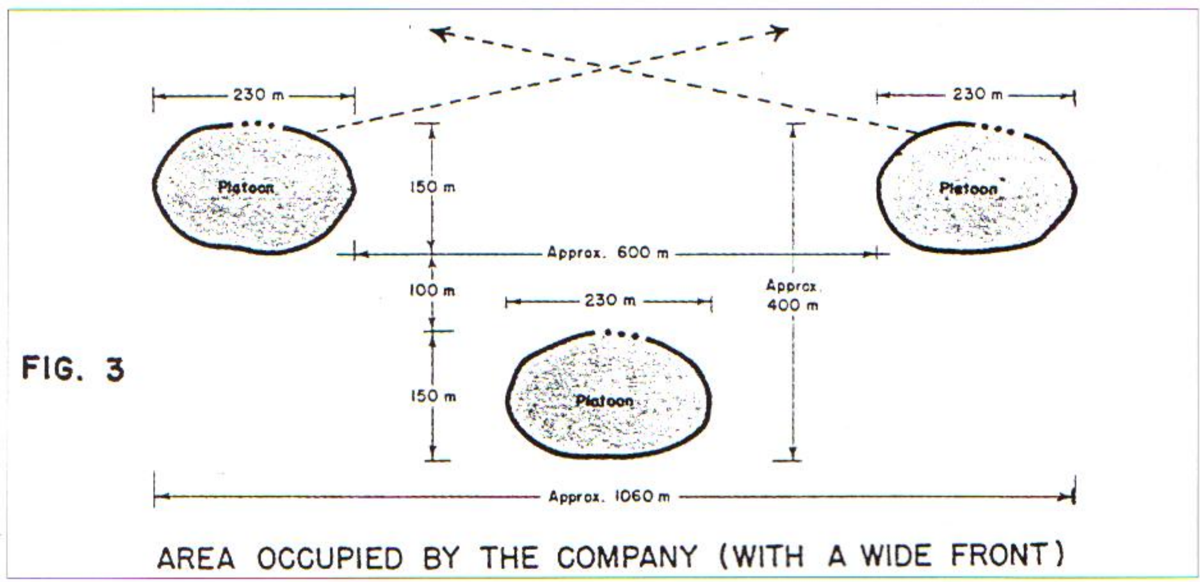
When the invasion force arrived offshore, the garrison was usually taken by some degree of surprise as their air and naval surveillance capabilities had long been eliminated. Even though the target island had long been under attack from the air and sea, so had other islands in the area and which would be the Allied objective could only be speculated as were landing beaches. The defense force was immediately alerted and deployed to their defensive positions, as were the reserve and service troops, in rehearsed actions. The Americans often conducted a landing demonstration off some other part of the island, but this seldom, if ever, led the Japanese to shift forces from the actual landing area.

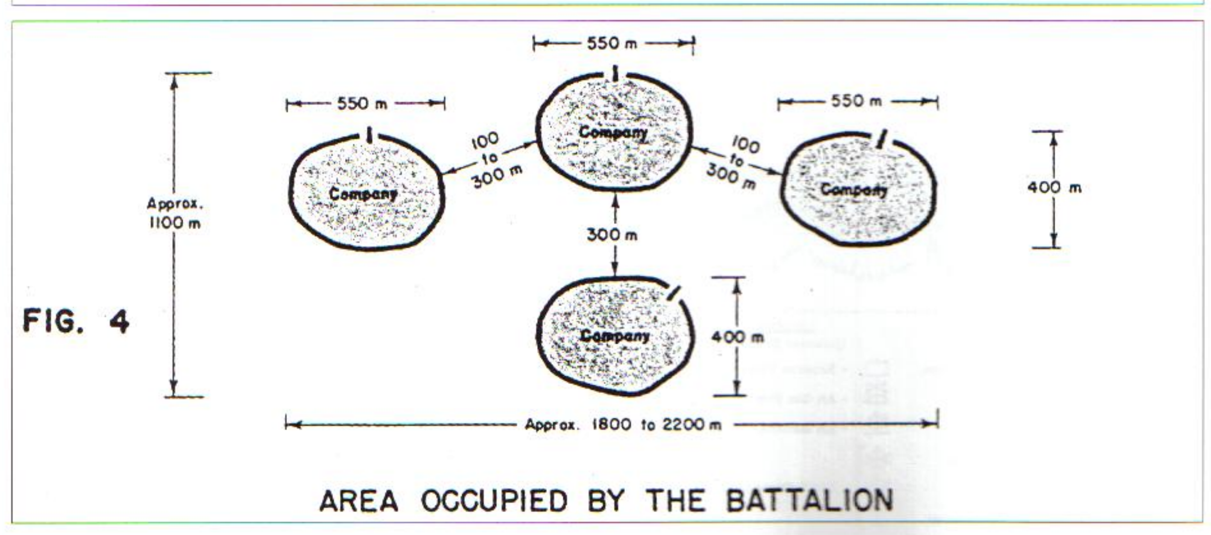


Japanese plan for the defense of a hypothetical coral atoll island reproduced in a 1944 issue of *Tactical and Technical Trends*. Note the Japanese expected the landing to occur on the ocean side of the island rather than from the atoll's inner lagoon side.









Doctrinally specified Japanese platoon, company, and battalion defensive areas.

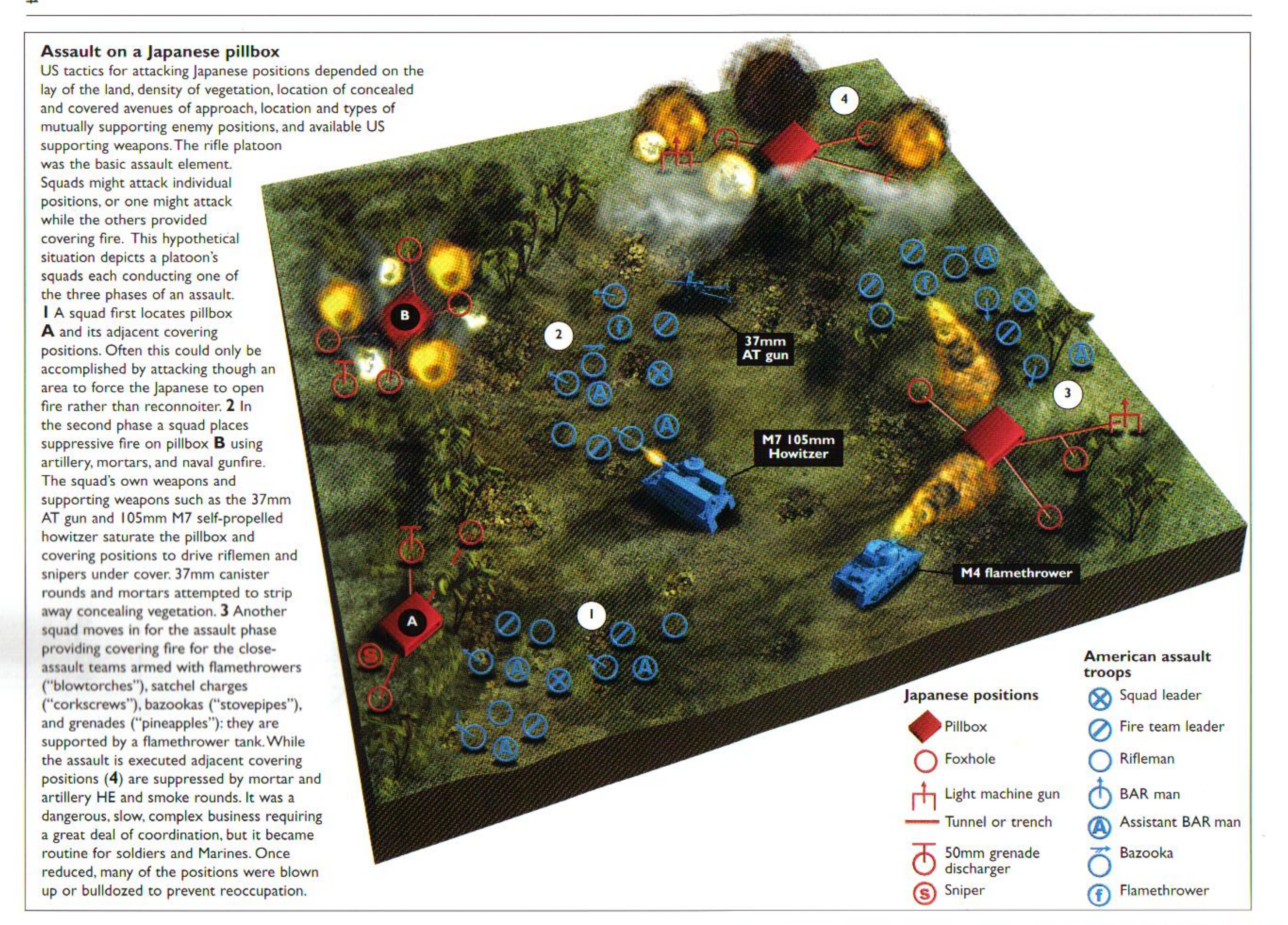
Bombardment from the air and sea intensified as the landing force headed for shore. Anything that moved ashore was struck by air or naval gunfire called in by circling spotter planes. Daylight movement all but ceased. The defenders hid in pillboxes, bunkers, bomb shelters, caves, tunnels, and trenches waiting to emerge when the bombardment ceased and the invaders stormed ashore. On Okinawa the practice was to position about one-third of a company in forward positions with the rest in tunnels and caves as a reserve. When artillery fire arrived all but 10–12 were withdrawn to shelter. The lookouts warned when the enemy advanced. Surviving coast defense guns often remained silent as they were knocked out as soon as they revealed themselves. Most of the well-constructed positions survived the massive bombardment and the impressive barrages had little effect. Even near misses had only marginal effect on the defenders with blast concussion. The major result of the pre-landing barrage was to keep the defenders inside their shelters, prevent them from shifting troops, provide some temporary disorienting effect, disrupt communications, and obscure their vision with smoke and dust.

The dangerous period for the landing force was the interval when the naval gunfire was shifted further inland as flights of fighters made final strafing runs over the beaches and the time the assault wave landed. From early 1944 modified landing craft, infantry (LCI) armed with 3in. guns, 4.2in. mortars, 20 and 40mm cannon, and 4.5in. barrage rockets accompanied the first assault waves towards shore maintaining a high rate of suppressive fire. Amphibian tanks with 37mm guns (75mm howitzers from mid-1944) would precede the amtracs, "shooting" them ashore and then rumbling on to attack pillboxes. Four to six waves of amtracs carrying assault troops came ashore, delivered them to the first available cover and then returned to pick up reserves. Landing craft in subsequent waves landed tanks and crew-served weapons. Regardless of suppressive fire, the Japanese would emerge and open fire with all available weapons on the approaching amphibians. Amtrac crews making repeated runs ashore suffered losses rivaling those of the infantry.

The fight on the beach was usually furious with many Japanese weapons revealing themselves as the first waves landed. Automatic weapons, artillery, mortars, and rockets (in later campaigns) were brought to bear as the assault troops struggled to gain a foothold. Often disorganized, suffering heavy casualties, with sporadic communication to request fire support, the invaders would push inland in small groups knocking out pillboxes, foxholes, and caves. While most Japanese died defending their positions as ordered, units and individuals were sometimes directed to withdraw and would reinforce subsequent positions. Other Japanese would attempt to infiltrate, especially at night, and reoccupy positions. Others were bypassed and would emerge at night to ambush and raid. It was critical that all weapons and munitions were recovered from the battlefield as the Americans advanced inland, because Japanese stragglers would pick them up. (US tactics employed to attack Japanese positions are described in the illustration on page 54.)

Assault on a Japanese pillbox

US tactics for attacking Japanese positions depended on the lay of the land, density of vegetation, location of concealed and covered avenues of approach, location and types of mutually supporting enemy positions, and available US supporting weapons. The rifle platoon was the basic assault element. Squads might attack individual positions, or one might attack while the others provided covering fire. This hypothetical situation depicts a platoon's squads each conducting one of the three phases of an assault. **1** A squad first locates pillbox **A** and its adjacent covering positions. Often this could only be accomplished by attacking though an area to force the Japanese to open fire rather than reconnoiter. **2** In the second phase a squad places suppressive fire on pillbox **B** using artillery, mortars, and naval gunfire. The squad's own weapons and supporting weapons such as the 37mm AT gun and 105mm M7 self-propelled howitzer saturate the pillbox and covering positions to drive riflemen and snipers under cover. 37mm canister rounds and mortars attempted to strip away concealing vegetation. **3** Another squad moves in for the assault phase providing covering fire for the close-assault teams armed with flamethrowers ("blowtorches"), satchel charges ("corkscrews"), bazookas ("stovepipes"), and grenades ("pineapples"): they are supported by a flamethrower tank. While the assault is executed adjacent covering positions (**4**) are suppressed by mortar and artillery HE and smoke rounds. It was a dangerous, slow, complex business requiring a great deal of coordination, but it became routine for soldiers and Marines. Once reduced, many of the positions were blown up or bulldozed to prevent reoccupation.



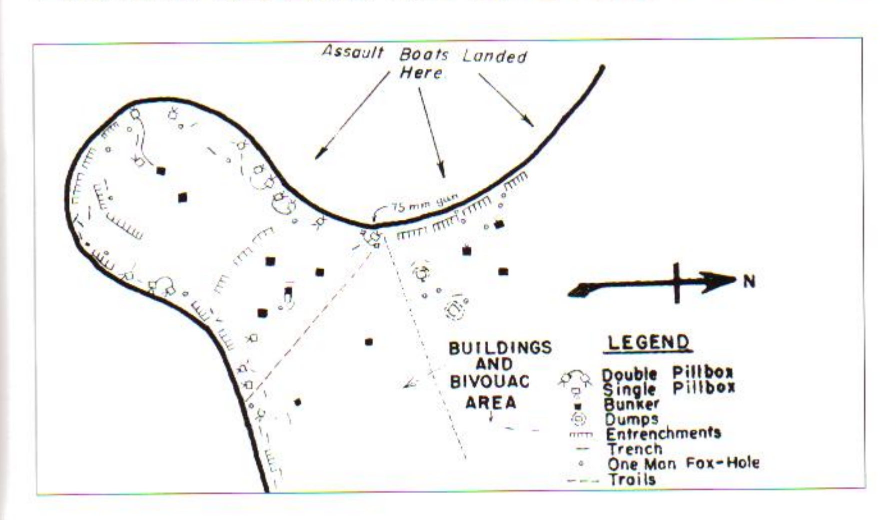
Island defenses – the test of battle

No two islands were defended the same nor were the types of defensive positions encountered on any two islands the same, even if under the same command in the same area. Space precludes detailed studies of specific islands. The examples discussed here are of comparatively small islands to provide examples of typical defenses.

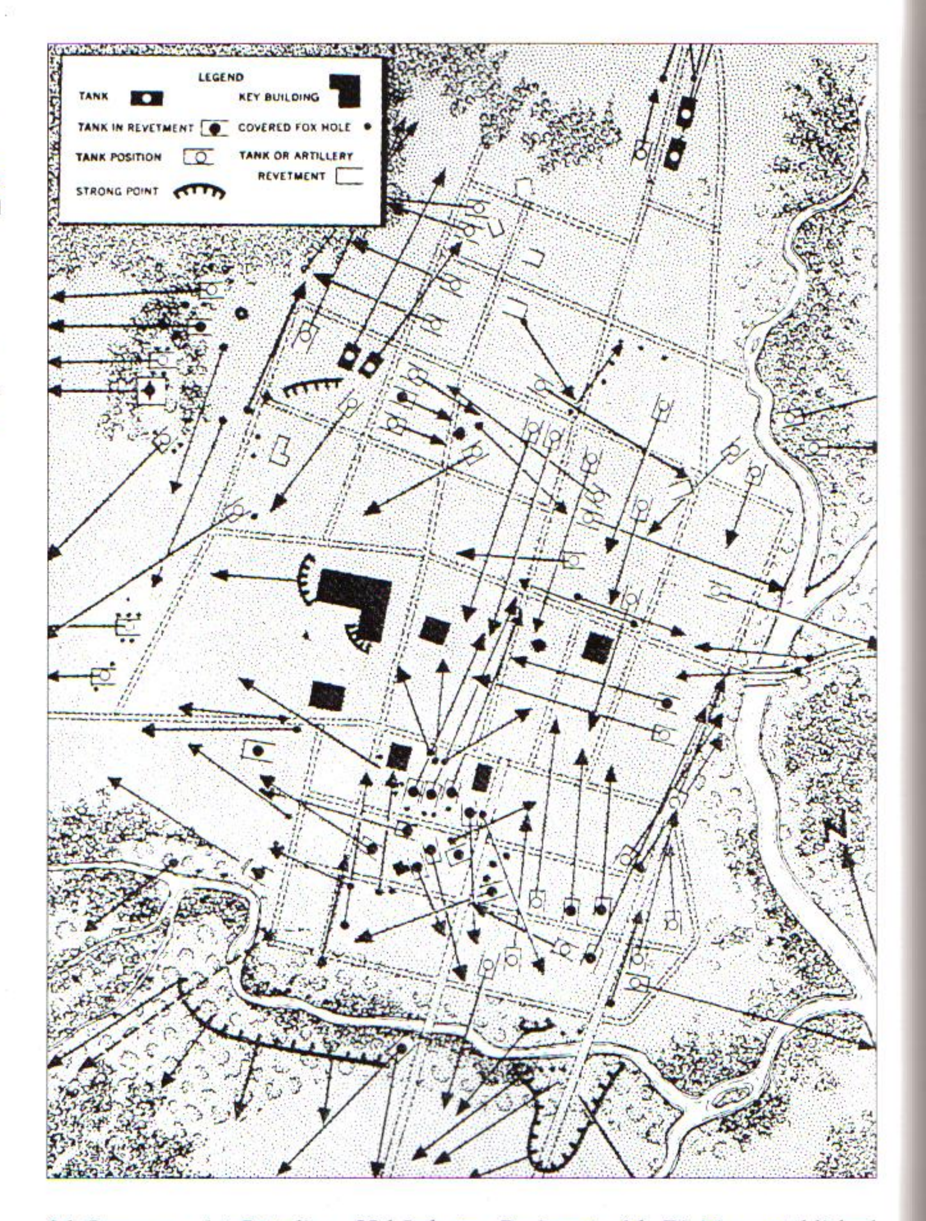
Cape Torokina, Bougainville, November 1, 1943

This example discusses a small, defended area on a much larger island. Bougainville was the northwesternmost and largest (38 × 125 miles) of the Solomon Islands. Its densely forested mountains ranged to over 10,000ft in the largely unexplored interior. The rugged southwest coast was backed by low coastal plains crossed by numerous streams. The beaches were very narrow and pounded by heavy surf unrestricted by coral reefs. Swamps backed many of the beaches. Empress Augusta Bay was located on the central-southwest coast and its northwest side was defined by Cape Torokina. Over 38,000 troops of the 17th Army garrisoned Bougainville and adjacent islands along with significant IJN elements, most of which were located on the southeast and northwest ends of the island. The Allied plan was to establish a beachhead at remote Empress Augusta Bay, build airfields to support the defense, later attack Japanese positions elsewhere on the island, and let the Japanese come to them where their movement over long distances and rough terrain would expose them to air attack and stretch their logistics capabilities.

The Japanese considered the island's northeast side the most likely landing site, but they did prepare light defenses at Cape Torokina. The low, flat sandy peninsula thrusts approximately 350 yards into the bay and is about 200 yards across at its mainland neck. It bulges to 300 yards across at its southwest seaward end. The cape is covered with palms, hardwoods, and moderate brush. The landing beaches were on its west side and on beaches stretching to the west. These are backed by swamps, some as wide as two miles and undetected by aerial reconnaissance, and dense forests. Some 1,300 yards southwest of the cape lies small, low, palm-covered Puruata Island. Between it and the cape is even smaller Little Torokina Island. Some 270 troops of the reinforced



A Marine sketch of the Cape Torokina defenses on Bougainville, November 1943.



Japanese defenses of San Manuel village on Luzon. While US forces attacked from the south where the main defense line was established, an all-around defense was provided for. Many positions within the village were also oriented to the flanks and rear. It was defended by an infantry battalion and a tank brigade with some 40 medium and five light tanks. They were backed by six 105mm howitzers, seven 75mm regimental guns, and two 47mm AT guns along with many machine guns. The Japanese attention to providing depth to the defense is readily apparent. Only key buildings are shown.

2d Company, 1st Battalion, 23d Infantry Regiment, 6th Division established the defenses on the cape and islets. Some 30 men were on Little Torokina and seven on Puruata from which they fired on passing landing craft heading for the beaches.

When the reinforced 3d Marine Division assaulted the cape on November 1 they found some 30 pillboxes and bunkers defending the peninsula and nearby beaches. Fighting trenches were interspaced between the pillboxes and foxholes, more than depicted on the drawing, were scattered among the defenses. The pillbox interiors measured 14ft to a side with 7ft ceilings. Some were lined inside with sandbags for splinter protection. They were built of 8–12in. coconut and ironwood logs held together by steel staples. Several layers of logs covered the roof and sand was piled high on the sides and top. This was planted with bushes and small palms for camouflage. Each had one to three firing ports at ground level allowing LMGs and HMGs to cover multiple sectors. Brush in the fire sectors was left in place, but leaves and branches were stripped off to 10in. above the ground, allowing the defenders to see approaching Marine boots. Most pillboxes were covered by other pillboxes and foxholes.

The beachside pillboxes and trenches were only five yards from the high tide line, denying the landing force cover from which to attack them. In the peninsula's interior additional bunkers and trenches protected the flanks and provided some depth, but not to the extent as later encountered. The small defending force lacked sufficient strength to provide this depth, effectively secure its flanks, and most seriously, had virtually no reserve as most troops necessarily manned the beach defenses.

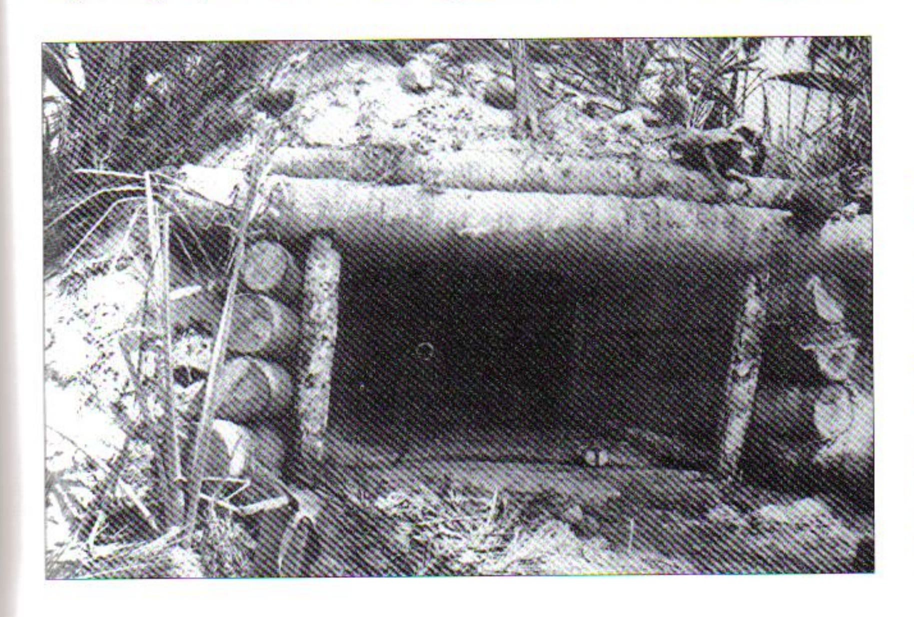
The defenses in the dense forest were invisible from sea and the brief 5in. gun barrage and air strikes inflicted virtually no damage on the heavily constructed positions. Landing craft were taken under fire by machine guns and the single 75mm regimental gun (see accompanying photo caption) 500 yards from shore. Units were mixed with many landing on the wrong beaches. The situation became more confused as Marines moved inland searching for enemy positions in the dense vegetation. Machine gun, rifle, and grenade discharger fire peppered Marines lagging on the beach causing numerous casualties. It required $3^1/_2$ hours for a reinforced Marine regiment to secure the peninsula because of the robustly constructed, well-camouflaged, defensive positions with a well-developed mutual covering fire plan. The Marines lost 78 killed and 104 wounded while the Japanese lost 192 dead with 68 withdrawing.

The Marines, soon joined by the Army, established a well-defended perimeter in which three airfields were built. For months the Japanese battered themselves attacking the perimeter before withdrawing to opposite ends of the island and waiting out the war until surrendering to the Australians.

Betio Island (Tarawa Atoll) November 20–23, 1943

The Gilbert Islands, comprising 16 atolls and separate islands, are located roughly halfway between Hawaii and Australia, and northwest of the Solomons. Tarawa Atoll, one of the largest in the Gilberts, is north of the group's center. The triangular-shaped atoll, devoid of islands on its west side, has over 40 islands and islets along its 18-mile northwest side and five scattered along its 12-mile south arm. Betio (pronounced Bay-shio) is the largest island in the atoll located on the west end of the south arm. It is 800 yards across its blunt west end and tapers to a narrow point 3,800 yards away at its east end.

The Japanese had built a 4,400ft airstrip occupying much of Betio Island's 291 acres. It was the only airfield in the Gilbert Islands and this made it an American target. They required the airfield to support the future Marshalls invasion. The



This heavily constructed Bougainville bunker housed a 75mm Model 41 (1908) regimental gun flanking the Marine landing beaches. The bunker was built of ironwood logs covered with 3ft of sand and lined inside with sandbags. Young palms had been planted on it for camouflage. A US 1-quart canteen lies in the embrasure for scale. The port is higher than normally found in most Japanese gun positions, but is typically set at ground level. This gun destroyed five landing craft and damaged ten in a matter of minutes using 50 of its 200 ready rounds.

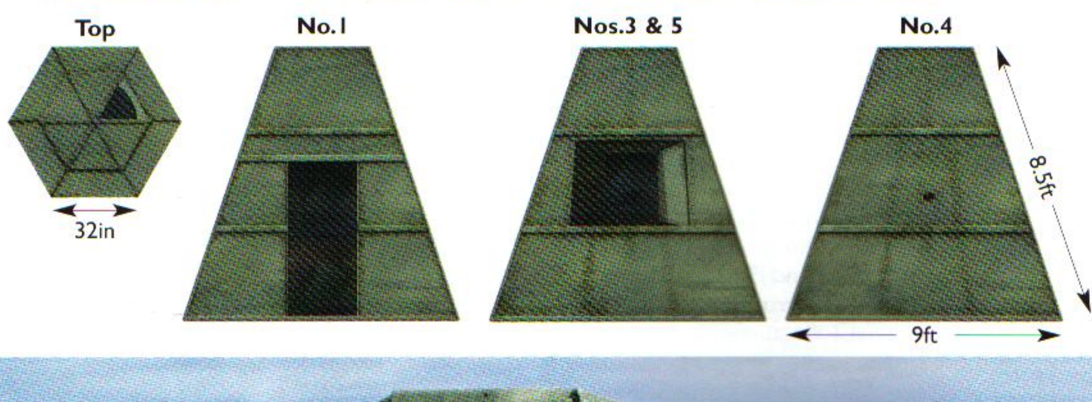
The portable steel pillbox

Steel machine gun pillboxes (*Kiju tochika*) were only encountered during the November 1943 assault on Betio Island, Tarawa Atoll, but may originate from the time of the Russo-Japanese War. The pillboxes were probably installed just prior to the assault. The defense was controlled from a number of these pillboxes emplaced at approximately 300-yard intervals around the island's perimeter behind the 3–5ft-high seawall. Serving as company command posts, their 8ft height was important given the island's 6ft elevation. As the Marines possessed few bazookas and flamethrowers, it required a near direct naval gun or Sherman hit to destroy them.

The hexagonal pillboxes were prefabricated, and erection required a derrick or A-frame. The side panels sloped 15 degrees: five of them were assembled from three riveted, trapezoid plates. The double-walls were 0.25in. thick with a sand-filled 12in. gap between them. Most were banked with sand on the outside, but this seldom reached to the upper edge of the bottom plates. Two examples were capped with 12in. of concrete.

The interior had a steel ceiling, level with the upper edge of the middle side plates. A 2.5ft-long hexagonal shaft ran through the ceiling to a roof hatch. The top portion around the shaft was filled with sand. The shaft was fitted with a metal seat, a voice tube to the lower compartment, and a 32in. diameter roof hatch from which to observe. There were no observation slits or periscope, forcing the observer to expose his head. The hatch consisted of six 0.5in.-thick triangular segments, each of which could be opened separately and swung outward. The lower compartment housed two HMGs for which integral mounts were provided.

The Japanese numbered the side panels clockwise. A 2 ft × 5ft, 0.5in.-thick steel, two-piece sliding door was set in the No. 1 panel (rear). This side was not double-walled, except for the top plate around the hatch access shaft. The other panels were Nos. 2 and 6 (solid, not shown), Nos. 3 and 5 (machine gun ports), and No. 4 (3 × 5in. vision slot). The firing ports measured 18 × 24in. internally and had sliding, two-piece, 0.5in.-thick steel shutters: the ports' outer wall openings were 36in. on the sides and top, and 42in. on the bottom.

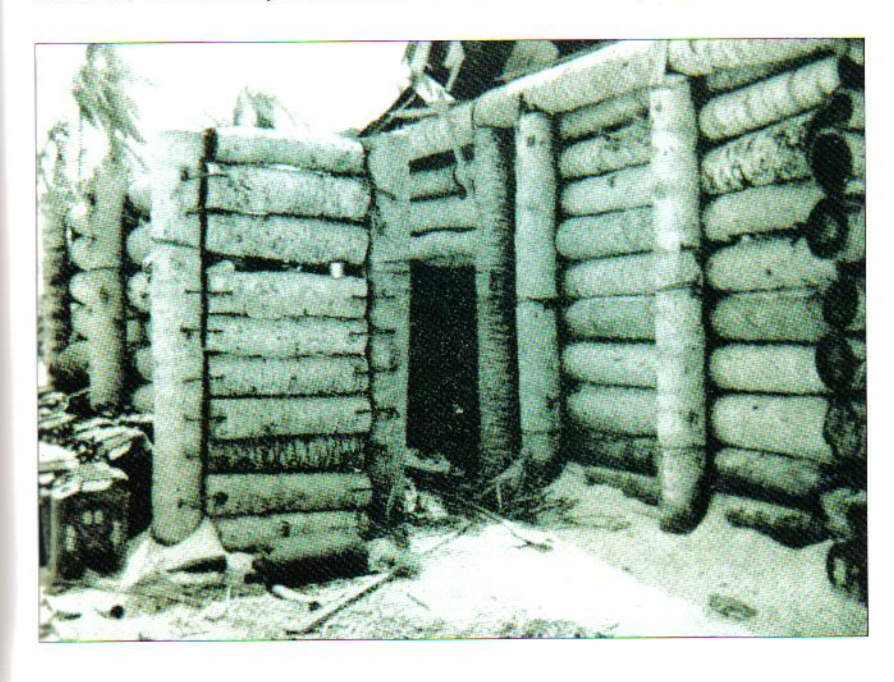




Japanese built over 500 pillboxes, bunkers, dugouts and a 3–5ft-high seawall around most of the island. Of particular interest are the unique portable steel pillboxes (see illustration on page 58). Most of the beach was lined with trenches and rifle pits immediately behind the seawall. Scores of 7.7mm LMGs and HMGs, 31 x 13.2mm HMGs, 9 x 37mm AT guns, 6 x 70mm battalion guns, 10 x 75mm regimental guns, 8 x 75mm AA guns, plus coast defense guns (6 x 80mm, 4 x twin 127mm, 4 x 140mm, 4 x 200mm) lined the beaches. Seven Model 95 (1935) light tanks were sheltered in revetments. Most of the defensive positions were heavily constructed of coconut logs fastened by steel staples with entrances protected by blast walls. With layered log roofs covered by sand, most positions maintained a low profile as they were dug into the sand. Heavy weapons were emplaced in clusters with some sectors near the lightly defended east. A major flaw was that the coast defense and many other larger guns were mounted in open emplacements – easy targets for naval gunfire and air bombardment.

The 3d Special Base Force, Sasebo 7th SNLF, and construction troops defended Betio with 4,866 men. The Japanese expected the main attack to come from seaward, but weapons were fairly evenly deployed around the perimeter. Underwater obstacles tended to be more frequent to seaward though, and most of the anti-boat mines were laid there. AT ditches were dug inland on the west end to channel tank movements. Others were dug across the narrow island east of the airstrip to prevent tanks moving up the island's length. Although the underwater obstacles were some of the most densely-placed in the Pacific, the tide caused the Marines the greatest problems: being lower than normal, it prevented landing craft from crossing the 500–1,200-yard wide reef. The use of amtracs to deliver the first assault waves saved the day, but following the loss of 80 of the 125 vehicles on the first day, there were not enough to land subsequent waves.

On November 20, 1943 the 2d Marine Division assaulted the western portion of Betio's north shore. The following 76 hours of brutal combat cost the Marines 1,084 dead and missing, and 2,233 wounded. It was the first instance US forces encountered exceedingly strong defenses at the water's edge. The controversial assault though provided many valuable lessons learned that reduced casualties in future operations including new pillbox assault tactics, improved naval gunfire techniques to defeat fortifications, increased allowances of bazookas and flamethrowers, the need for UDTs to clear obstacles, the necessity for armored amtracs to land troops, and more.



This blast wall surrounds a wood-frame building on Betio. It had only a pitched corrugated steel roof and lacked bombproof overhead cover. The blast walls were made of 8–10in. diameter coconut logs coupled together with steel staples. The blast barrier protecting the door as well as the blast wall are made of double layers of logs filled with some 2.5ft of sand. To the left are Marine 5-gallon water cans.

Makin Island (Butaritari Atoll) November 20–23, 1943

Makin (a.k.a Butaritarin Atoll) is 10 miles long and averages 500 yards wide: it has a maximum elevation of 12ft, and is mostly covered by palms and salt brush. The Japanese established a seaplane base here early in the war. Marine Raiders destroyed the small base in August 1942, but this resulted in the Japanese heavily fortifying Betio and Makin. Defended by 798 men of the Makin Detachment, 3rd Special Base Force and construction troops, the island was far too large to establish a perimeter defense as on Betio. Lacking an airstrip, it was less of a priority.

The Japanese established a central defense area around the old British colonial government area 2,500 yards east of the T-crossed west end. The defense area was 3,000 yards wide flanked by cross-island AT ditches. A 100–200-yard-wide band of vegetation was cleared at these ditches. This clearly identified the defended area to naval gunfire and aerial observers. The island's width here is 350–550 yards. The ocean (south) side reef is 100–200 yards across and the lagoon's side is 50–1,500 yards. A dozen machine guns, three 37mm AT guns, and numerous trenches were scattered along the south shore with three 80mm guns in a central position. Fewer machine guns defended the north shore and there were few trenches. Most of the machine guns covered the three concrete and stone piers jutting into the lagoon with three 80mm guns near the central King's Wharf. The Japanese clearly expected the attack to come across the south side's narrow reefs. They also concentrated their defenses at the extremity of the defense area at the AT barriers. More machine guns and a few AT guns covered these along with a lone 70mm battalion gun at the west barrier. There were only minimal inland defenses in the area's center, providing little depth.

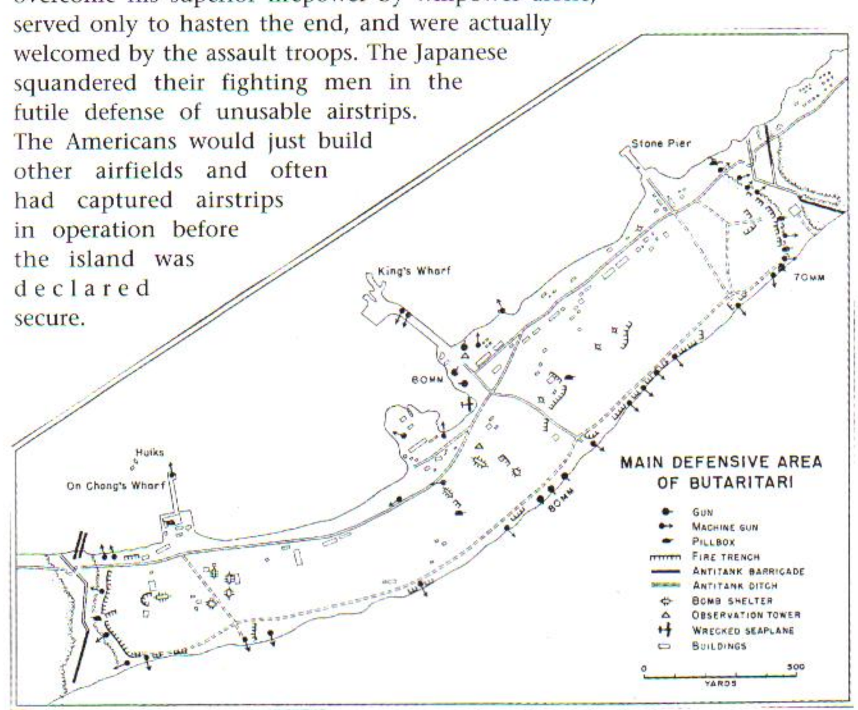
The reinforced 165th Infantry Regiment, 27th Infantry Division was assigned the mission. Most of the US force landed on Makin's west end unopposed. The reef hampered the landing and if the beaches had been defended it could have been a disaster. Further delayed by rough terrain, they advanced towards the west AT barrier, the less well defended of the two. Two hours after this landing a second assault hit the defense area's western portion. Receiving only light fire, the troops attacked in both directions. The defenders of the west AT barrier were trapped between the two US forces. Others withdrew eastwards as a US company landed 4,000 yards east of the defense area to block them. US losses were 66 dead and 158 wounded. A little over 100 of the enemy were captured.

The operation proved the futility of a small force attempting to defend a large island by holding a central strongpoint. It gave the assault force too much freedom of action and room to maneuver, allowed the establishment of artillery on-shore, and the build up of supplies. The Gilberts taught the Japanese other lessons. In the Marshalls and Marianas they attempted to provide amphibious reserves to reinforce islands under attack and planned to launch massive air assaults on the invasion fleet. These too failed.

An assessment of the Japanese defenses

The very concept of Japanese island defense was flawed, at least in the regard to their belief that they could successfully repel an Allied landing or defeat the landing force in detail by fire and maneuver once ashore. Even though they accepted the inevitable destruction of the garrison as a means of wearing down the enemy and slowing his offensive across the Pacific to allow for counter-strikes (for which the assets did not exist), they achieved little. The collective will of the Allies and the virtually unlimited resources available to them would not force them to halt their offensive much less sue for peace.

By building airfields to protect their conquered territories they only attracted the Allies. The concept of establishing numerous airfields and naval facilities in an area from which to attack an invading fleet was defeated by massive Allied air and naval forces neutralizing and destroying those bases. Relying on external mobile reserves to reinforce and counter-land on threatened islands was fantasy. Coast defense and AA guns were largely destroyed by air and naval bombardment. The amtrac-transported assault troops always made it ashore regardless of the amount and effectiveness of Japanese firepower. Mobile reserves on the island objective itself could not maneuver in daylight, counter-attacks immediately after the landing when the assault troops were most vulnerable were piecemeal and ineffectually small, and tanks were never committed in time to attack the somewhat disorganized assault troops clinging to a shallow beachhead. Often local counter-attacks, larger-scale counter-offensives, and counter-landings were uncoordinated and conducted piecemeal, leading to their easy defeat. Suicidal *banzai* charges, intended to crush the dispirited enemy and overcome his superior firepower by willpower alone, served only to hasten the end, and were actually welcomed by the assault troops. The Japanese squandered their fighting men in the futile defense of unusable airstrips. The Americans would just build other airfields and often had captured airstrips in operation before the island was declared secure.



Because of the Marine raid on Butaritari Island, the occupied Gilbert Islands were heavily reinforced and upgraded defenses prepared there and on Tarawa. This diagram depicts the island's defenses when the Army landed in November 1943.

The sites today

Few Japanese field fortifications have survived the war, the 60 years of harsh climate, new construction, and the jungle reclaiming the islands. Intended only as temporary fortifications and built of largely non-durable materials, years of rain, wind, and rot have caused them to waste away. They were often bulldozed by the Allies, and airfields, military bases, and support facilities were built over them. Locals stripped them of usable materials for their own construction or to sell as scrap. Commercial construction and cultivation claimed more as those adjacent to beaches were washed away by changing shorelines. Crumbling concrete pillboxes, fortifications, and bunkers can still be seen on some islands, but these too are deteriorating as cracks are caused by rain and rebar rusts away. Concrete command posts and communications blockhouses are still standing, but crumbling.

Often gun positions appear only as shallow depressions choked with vegetation. Entry to cave and tunnel positions, the latter collapsed long ago, is usually restricted on most islands as they are extremely unsafe. The remnants of wrecked Japanese and Allied aircraft as well as tangles of Japanese hangar frames are found on some islands, usually where they were bulldozed out of the way to make room for new Allied construction. Even tank hulls and large-caliber guns may be found along with small items of badly deteriorated equipment. Many of the steel pillboxes remain on Betio along with some of the large concrete gun positions. Peleliu offers some of the best examples of remaining fortifications, even though little preservation effort has been undertaken, due to the nature of the terrain.

One of the few places where some fortifications have been preserved is Okinawa, including the IJN command tunnel system. On some of the more developed islands a few old guns, aircraft hulks, and vehicles have been assembled at outdoor "memorial parks" as an unadorned tourist attraction, but these too are mostly deteriorating. Little effort has been made to preserve fortifications.



A Marine assault team on Okinawa. This lethal combination of M2-2 flamethrower, M1 rifle, M1918A2 Browning automatic rifle, hand grenades, and satchel charges borne by determined young men led to the defeat of virtually any Japanese fortification.

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A Marine discharges an M2-2 flamethrower into the entrance of a bunker. The jumbled logs and scarred earth demonstrate how the camouflage was blown away by demolition charges and bazookas, exposing the entrance to attack.

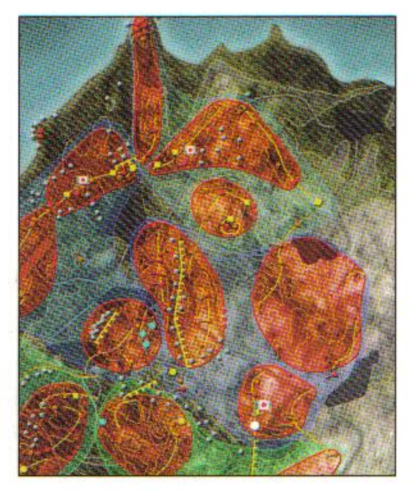


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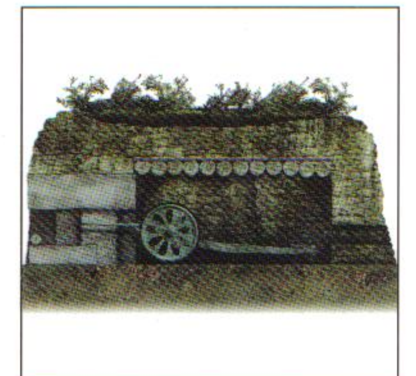
Design, technology and history of key fortresses, strategic positions and defensive systems

Japanese Pacific Island Defenses 1941–45

The prolonged and bloody fighting for control of the Japanese occupied Pacific islands in World War II is a key point in 20th-century warfare. No two islands were alike in the systems and nature of their defensive emplacements, and local improvisation and command preferences affected both materials used and defensive models. This title provides a detailed and authoritative examination of the establishment, construction and effectiveness of Japanese temporary and semi-permanent crew-served weapons positions and individual and small-unit fighting positions. Integrated obstacles and minefields, camouflage and the changing defensive principles are also covered.



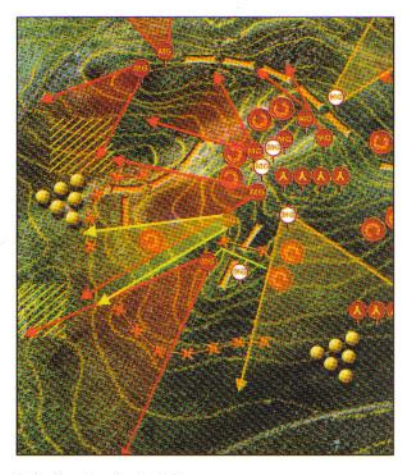
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